The Builder.

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Sutton's Hospital in Charterhouse.

IN our issue of the 5th December we briefly announced that Charterhouse in London is marked for destruction in order that part of the site may be turned to more profitable account. Of the many similar projects which we record from time to time we know none that should arouse in any but the most strictly utilitarian quarters a greater degree of interest. Standing remote, northwards of Charterhouse-square, and having lately escaped conversion into a fish-market, the buildings are unfamiliar to the general passer-by.

Many, doubtless, were surprised to read that the recent vast conflagration in Clerkenwell threatened to forestall the governors' present plans, and actually damaged the belfry behind what used to be Wilderness-row. Yet some will recall it to mind as the first *alma mater* of Wesley and Isaac Barrow; of Blackstone and Lord Ellenborough; the school of Lovelace and Crashaw; Eastlake and John Leech; of Havelock and John Stewart; wherein Thirlwall and Grote, Addison and Steele were form-fellows. Thackeray seems to have entertained no great regard for the few months he passed at "Slaughterhouse" or "Smiffles;" yet latterly, as his writings testify, he evinced a strong affection for the home of the "Cistercians" and their associations with "Grey Friars."

Singularly to tell, the earliest history of Charterhouse is closely associated with that of the Great Pestilence which ravaged Europe in the fourteenth century. Hecker describes for us the progress and desolation of the Black Death. Travelling from China to the East, it passed onwards from the Levant into Italy (as commemorated by Boccaccio), and thence over Spain, France, and Germany, into Great Britain. Stow relates how, entering our island in Dorset, and speeding onwards into Devon, Gloucester, and Oxford, it at length came to "London, and overspread all England, so wasting the people, that scarce the tenth [*sic*] person of all souls were left alive, and churchyards were not sufficient to receive the dead, but men were forced to choose out certain fields for burials; whereupon Ralph Stratford, bishop of London, in the year 1348, bought a piece of ground [some three acres in extent] called No Man's Land, which he enclosed with a wall of brick, and dedicated for burial of the dead." Pennant, be it noticed, identifies this plot with Pardon churchyard, since used for interment of suicides and criminals.* No Man's Land, formerly in St. Sepulchre's parish, is held by many authorities to correspond with the Crown holding cited in Domesday Book as being near to Newgate; one of the only two places in London, by the way, mentioned in that survey. Adjoining to No Man's Land was Spittle Croft, of thirteen acres, attached to St. Bartholomew's Spital,—whose parish was taken out of St. Sepulchre's at the Suppression,—which Sir Walter de Manny, a Flemish retainer of Philippa, King Edward III.'s bride, and a hero in her husband's French wars, purchased and applied to a like purpose. Quoting the inscription of a stone cross he had seen there, Stow avers that in 1349 more than 50,000 persons were interred in these two grounds. Some twenty years later the site was taken for that monastery,—not the first of its order in England,—for which was adopted the ascetic rule of Chartreuse founded by St. Bruno at Grenoble, and to which Michael de Northburgh, bishop of London, 1354-1361, proved a large as he was a first benefactor.† Northburgh is reputed to have persuaded De Manny to convert the latter's intended college for a warden, dean, and twelve priests secular, into a priory for twenty-four monks. Other holdings were acquired by the Carthusians, such as Hervye's Croft and Newchurch Haw; and to the south-eastern corner of the rest, an acre which in 1429 was let to them at an annual rent of a red rose by one William Rendre, citizen and barber. Rendre's acre, being pasture land, lay in Conduit Shoot near to Trillemille Brook in St. Andrew's de Holborn, and eastwards of the king's highway leading from Holborn to the prebendal manor of Kaunteloe (Kentish Town). The precincts have always been extra-parochial.

The fortunes of the House of the Salutation of God's Mother attained to their apogee during the priorship of John Houghton, when, *teste* Dugdale, their revenues amounted to 642*l.* a year. The monks were visited with a signal share of royal displeasure. For contumaciousness in the matter of the king's supremacy, Prior Houghton and Proctor Middlemore were (1534) committed to the Tower. Nor did speedy submission secure their safety. In 1535 Houghton was again imprisoned, and, with some monks, executed at Tyburn, May 4. On their way to the scaffold they were seen by Sir Thomas More, himself a captive, who had spent some time in religious retreat in Charterhouse. One of Houghton's arms was set over the gateway, opposite to the Hall, leading from the entrance-court into the main or Hall court. Such of the monks as still held out against Fylott, Cromwell's visitor, were severally disposed of by execution, or the cruellest of imprisonment in Newgate at the hands of his agent, Thomas Bedyll. Other monks remained under William Trafford, the last prior, and two-and-twentieth of his house. A small party, who had sought refuge in Bruges, were reinstated by Mary, and to them her sister and successor granted a safe conduct to return abroad.

Most noteworthy is it to read how Charterhouse met with a fate different from that which generally overtook the dispossessed monasteries. It ultimately became, in fact, the home, in turn, of certain allied noble families. Having served for a while, like to the neighbouring priory of St. John of Jerusalem, as a storehouse for Henry's pavilions and nets, together with other equipments for the chase, it was granted (1542) to Thomas Hall and John Bridges for their joint lives. The king next gave it to his Lord Chancellor, Sir Thomas Audley,—Lord Audley, of Walden, whom he also endowed with the priory of Holy Trinity without Aldgate. In April, 1555, Lord Chancellor Audley sold Charterhouse to Sir Edward North, treasurer to the Court of Augmentations, elevated Baron North of Kirtling, county Cambridge, 17th February, 1554. Lord North sold it for 2,500*l.* to John (Dudley) Duke of Northumberland, at whose execution it again reverted to him by grant of the Crown. By deeds, dated May 31 and June 7, 1565, Roger, second Lord North, husband to Winifred, daughter of the Lord Rich who had succeeded to the adjoining St. Bartholomew's priory, conveys the property for 2,820*l.* to Thomas (Howard) fourth Duke of Norfolk, whose second wife was Margaret, daughter and sole heir to the named Thomas, Lord Audley of Walden. The house he here built for himself was for a while the Duke's prison-house. For having been committed to the Tower when a plague broke out in the Tower liberties, he was allowed to return hither under the easy custody of Sir Henry Neville. But scarcely within a few months of the completion of his design he was again seized and reconveyed to the Tower. At the Duke's conviction and attainder (1572), Charterhouse was made over to his second son, Thomas, who, succeeding to his mother in the barony of Walden, was here, in the existing great Hall, advanced Earl of Suffolk (May 4, 1603) by James I. On that day James made his public entry into his new capital, and willing to show respect to a family who had so suffered in his mother's cause, turned aside from out of Aldersgate-street to the then Howard House, which he reached at six in the evening. Here he and his following were right

* Pardon Church lay between the new Clerkenwell-road and Sutton-street; the site was afterwards given to a Welsh congregation.

† *Vide* Archdeacon Hale's account in the "Transactions of the London and Middlesex Archæological Society," iii.

regally entertained for a space of four days. Hence James went to Whitehall, and so to the Tower. With his customary rapacity, the Earl of Suffolk alienated Charterhouse, 9th May, 1611, to Thomas Sutton, Master-General of the Ordnance in the North, for 13,000*l.* Sutton died on December 12th (ever since commemorated as Founder's day) of that same year. In this short interval, having long desired to so devote, in his own words, a large and liberal estate to public good, he endowed what Fuller justly terms "a masterpiece of Protestant English charity," and which until Guy's time stood, says Pennant, as "the greatest gift in England, either in Protestant or Catholic times, ever bestowed by one man."

The last-named writer is hardly correct in declaring that "there is scarcely any vestige of the conventual building, which is said to have stood in the present garden." The Preachers' and Pensioners' Courts are Blore's work, it is true. Yet the curious might find some cells and other remains southwards of the playground; also in the kitchen, *antiquè* "Egipte, the fleyshe kychyne"; in the basement, western end, of the earlier school; and by the Chapel tower. Evidence House (the muniment-room), Washhouse-court, and the Cloister, present several relics. Yet these, albeit highly interesting in themselves, yield in value, from the structural point of view, to their later surroundings. For in them we have a most excellent,—and, indeed, in London a quite unique,—example of a nobleman's private residence *temp.* Queen Elizabeth and her successor. The Officers' Library and the Drawing (or Governor's) Room, reached by a magnificent staircase of date 1571, were occupied by Elizabeth, as yet uncrowned, when on her way from Hatfield to the Tower. She stayed here from the 19th to the 28th of November, 1558, as the guest of Lord North. The interior of the Great Hall* is remarkably fine. It is unquestionably the Duke of Norfolk's work, since his initials and date T. N., 1571, are repeated in the carving. Its chimneypiece, as also the entrance to the chapel, are of Sutton's time. So important, indeed, are these several features that they may well form the subject of a separate article. Their details may be studied at leisure in the set of views taken (1880) for the Society for Photographing Relics of Old London, *e curis* Mr. Alfred Marks, to whom we are indebted for some valuable information not available to the ordinary visitor, and on points but dimly discernible in a winter's dark day.

We cannot here discuss the merits of the school's removal in 1872, followed by the migration hither of the Merchant Taylor boys from Suffolk-lane. The pious founder provided a free school for only the children of poor men; at their first meeting, July, 1613, the Governors confirmed these conditions. We can but surmise with what astonishment Sutton, did he arise from his costly alabaster tomb in the Chapel, would regard the buildings that crown the high lands northwards of Godalming; of his kindred foundation we are reluctant to speak. Comforted and relieved in their failing years, the pensioners move hither and thither in their high hats and long gowns like to ghosts of a time and usages which this age has well-nigh forgotten; or finding, at once seeks to change. In his "Sketch-book" (London Antiques) Washington Irving dwells with exquisite fancy upon the quaintness and sanctity that surround the closing years of these necessitous gentlemen. Thackeray's stronger hand has touched upon the pathos of their situation; his account culminates in that passage wherein he tells us how within sound of the chapel bell, and with "*Adsum*" on his lips, the Colonel, "whose heart was as that of a little child, had answered to his name, and stood in the presence of The Master."

Society of Engineers.—The Society of Engineers will hold its annual dinner at the Guildhall Tavern on Wednesday next, the 16th of December.

* Styled by the boys "Old Codds' Hall"; their own they named "Young Codds' Hall."

WATER MAINS.

IT is usually considered necessary to give mains, and, indeed, every size of pipe conveying water, a cover of 3 ft., neither more nor less, this particular depth of cover being regarded as sufficient to meet the exigencies arising out of the necessity of offering resistance to the effects of frost, the concussion caused by traffic in the street or road above, and a convenient depth for examination and repair. The excavation of a considerable length of the trench is usually made before any of the pipes are placed in position, so that they may rest upon firm or "unmoved" ground, with the exception of a short length at the joint, where holes are formed of sufficient width and depth to admit of the pipes being joined with freedom. It is not usual, however, to excavate at any one time a greater length of trench than the pipe-layers can keep pace with, as unnecessary interference with traffic might accrue, and, for similar reasons, the trenches are refilled at the same rate as the pipe-laying proceeds. When the trench has to be hewn out of the solid rock, which is not unfrequently the case, it is excavated at a slightly increased depth, and about 6 in. of soft material is then laid upon the rock, forming a bed for the pipe to rest upon. In refilling the trench, after the pipe has been laid, the material ought always to be carefully beaten and consolidated at every 8 in. of depth, the finest being selected for immediate contact with the pipe. Sufficient space is left to receive the bottoming for the metal or paving stone requisite to properly restore the surface of the street or road. When the pipes pass through fields and the top of the pipe is necessarily near the surface of the ground, an embankment is formed of the surplus material from the pipe trenches, so as to give a cover of at least 2 ft., a convenient slope for this being 4 to 1. The soil must first be removed from the site of the embankment, and afterwards replaced, and neatly trimmed off and sown down. Where pipes have to be taken across bridges very little depth of cover is usually obtainable. In order, therefore, to secure the least possible exposure to the effects of vehicular traffic, the pipes are laid under the footpath, the bed for which is prepared at as great a depth as can be obtained. They are then surrounded with fresh concrete, and the pavement carefully relaid in a bed of mortar. Fig. 1 illustrates a case of this kind, the

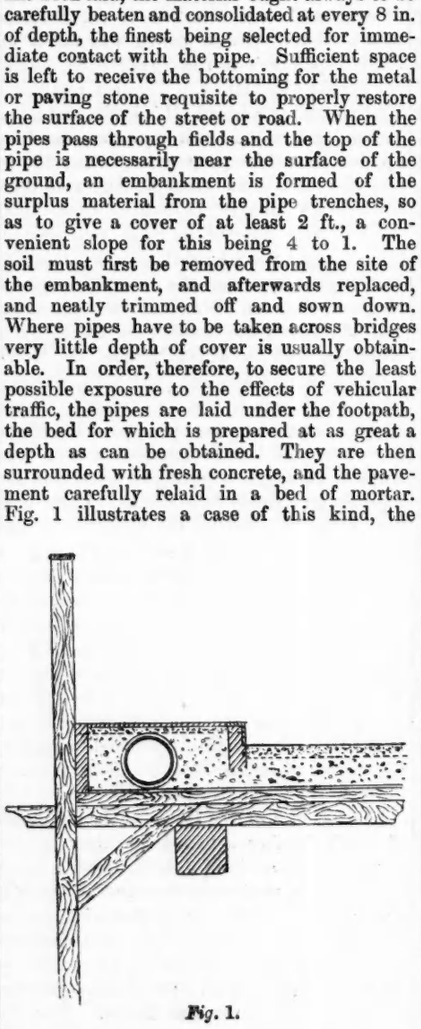


Fig. 1.

section being taken through the centre of the bridge, the dotted line representing the level of the footpath and surface of the road at the ends of the bridge. In circumstances where the ground is too soft to admit of the pipes being properly and firmly bedded they are rested upon short lengths of Baltic white pine deals, 9 in. by 3 in., and secured by hard-wood slack blocks, 4 in. by 4 in. at thick end, and 2 ft. long, placed one on each side of the pipe, and firmly driven, so as to give the pipe a proper bearing. The length, number, and distances apart of these supports are regulated from time to time as circumstances may dictate.

Where small streams are crossed it is often customary to carry any water that may be flowing down them at the point of the crossing of the water-mains, through pipes of a sufficiently large diameter to meet the requirements of the case. Where streams exist, when this cannot be conveniently done, it is often necessary to cross them by flanged pipes, affording them a substantial support of masonry or concrete abutments on both sides, hollowed out about 3 in., to receive the pipes. When exposed, they are covered with red Norway battens, $6\frac{1}{2}$ in. broad and $2\frac{1}{2}$ in. thick, selected, and free from sap-wood, cut to the proper bevel at the edges and curve at the top, and the whole creosoted. The battens are laid on the top of the flanges, fitted close, and secured by wrought-iron straps, 3 in. by $\frac{3}{8}$ in., and keyed up with cottars. The stonework of the abutments is dressed off, so that the wood may fit close; but the covering should not be put on till the joints have been properly tested.

In dealing with the case where a river of considerable width has to be passed, and no suitable means of transit exist, two alternatives present themselves,—either a bridge must be constructed, which might prove a very expensive undertaking, or the pipes must be laid under the bed of the river. The determining factor, of course, is the question as to which, taking everything into consideration, would be ultimately the more economical. The latter wa adopted some time ago, when a line of 36-in pipes was laid below the river Clyde. Before we proceed to describe in detail the system of cofferdam adopted, it would be interesting to refer for a moment to a passage in Mr. Samuel Smiles's "Lives of the Engineers," p. 392, where he tells us how "James Watt, in his seventy-fifth year, was consulted by the Glasgow Waterworks Company as to the best mode of conveying water from a peninsula across the Clyde to the company's engines at Dalmornock, a difficulty which appeared to them almost insurmountable; for it was necessary to fit the pipes through which the water passed to the uneven and shifting bed of the river. Watt, on turning over the subject in his mind, shortly hit upon a plan, which showed that his inventive powers were unimpaired by age. Taking the tail of the lobster for his model, he devised a tube of iron similarly articulated, of which he forwarded a drawing to the waterworks company, and, acting upon his recommendation, they had the tube forthwith made and laid down, with complete success. Watt declined to be paid for the essential service he had thus rendered the waterworks company; but the directors made a handsome acknowledgment by presenting him with a piece of plate of the value of a hundred guineas, accompanied by the cordial expression of their thanks end esteem." When we compare the early engineering enterprise as exhibited in the above reference, with its modern development, illustrated in the following details, the effect is not a little entertaining. A cofferdam was formed, consisting of two parallel rows of main piles, from 12 in. to 14 in. square, which were driven 9 ft. from centre to centre, the piles in each row being 6 ft. apart. Each 6-ft. space was filled in with 10-in. sheet piling, driven between a double line of wales, and a double line of guide wales, 12 in. by 6 in., checked and bolted by $\frac{3}{4}$ in. bolts to main piles, so that, in driving, the direction of the piles was under complete control. The edges of all the piles and walings were sawn straight and parallel, the joints caulked, and the dam puddled outside, and made perfectly watertight. The dam was so strutted inside as to preserve the parallelism of the two rows of piles, and supported from the down-stream side, so that it was able to withstand the force of the river when in flood. The piles were all ringed at the top, and shod. Not more than one-third part of the width of the river was occupied by the sheet piling of the cofferdam at any one time. Although the space occupied by the main piles and the piles of the staging necessary for gaining access to the work occupied an additional width, a clear space of 50 ft. was maintained at all times for the

passage of vessels. Rows of 6-in. sheet piling were driven across the dam between the two rows of main piles, in advance of the pipe-laying, and at such distances apart as admitted of six pipes, each 12 ft. long, being laid at one time. After each six pipes were laid, a row of sheet piling or 6-in. planking was placed across the dam on the top of the concrete, which was put round the last pipe laid, and both this and the sheet piling in advance were caulked, strutted inside to the main piles, and puddled up on the outside, so that the dam was perfectly water-tight. These cross dams or bulkheads were placed sufficiently far from the end of the last pipe laid, to allow of the joints being made with freedom. After the excavations inside the cofferdam were made to the proper depth, piles, 12 in. by 12 in., were driven several feet into the bed of the river and the heads cut off level, and hollowed out to receive the pipes. Every second pipe was fastened by a wrought-iron strap to two piles, with the heads cut level with the top of the pipe. In the places where the cross dams were put inside the cofferdam, the trench was filled in to the level of the top of the pipe with Portland cement concrete, mixed and laid down so as to be perfectly water-tight. The concrete was composed of one part cement, one of clean river sand, and two of clean gravel, which, after being thoroughly mixed, was immediately used. While the trenches were being cut, it was necessary to work the pumps constantly, though the difficulty met with in respect of water was not so great as had been anticipated. After the pipes had been laid, the trenches were refilled with the material, and excavated to the level of the bed of the river, the sand and firm parts of the material being put next to the pipe. The process of laying the pipe was somewhat peculiar. The inner portions of the turned and bored parts were, after being carefully scraped and cleaned, paid over with a little thick anti-corrosive brown paint, and two pipes put together so that they might lie in the same straight line, and forced home by two screw bolts secured to a jointed ring round the socket of the pipe last laid, and to a strap across the socket of the pipe being laid. The pipe was then held in this position till the joint had been run. A piece of ropeyarn, prepared to the proper size, was then put into the socket, but not driven so far in as to prevent the lead completely filling the space prepared for the purpose, and kept in its place by a jointed clasp ring. The lead was run into the joint through holes bored into the socket, and to secure the utmost solidity of the lead joint, one-half more hot lead than was required was kept at hand in ladles. The ropeyarn was afterwards taken out, and then any lead which had found its way into the outer part of the socket was carefully removed. A piece of $\frac{3}{4}$-in. wrought-iron tube was screwed into the centre hole in the socket, adjusted to stand at right angles to the axis of the pipe, sufficiently long to reach above the surface of the water after the pipe had been sunk, and marked in feet and inches. Each pipe was lowered into its position gradually by means of tackle attached to it, and in such a manner that the joint would not at any time be canted more than 2 in. or $4\frac{1}{2}°$ off a perpendicular to the axis, the tubes fixed into the sockets enabling this to be done with accuracy, these tubes being afterwards removed. After the pipes had reached the proper depth, a quantity of sand was thrown in round them, so that the action of the water might carry it below the pipe, and give it a uniform bed at the required level.

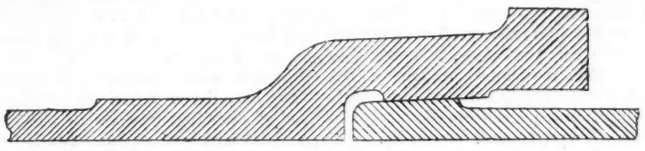


Fig. 2.—Turned and Bored Joints.

The pipes in general use for distances where there are no bends in the line have turned and bored joints, the latest and most improved design for which, now adopted in all important works, is illustrated in fig. 2. But when deviations from the straight line occur, plain socket joints for lead are used. The special castings, of which there are numberless varieties, to suit every condition in which a pipe may be placed, except where they are provided with flanges, have also plain socket joints, as illustrated in fig. 2. It is always necessary, before lowering a pipe into the trench, to carefully brush it through, so as to remove any soil, stones, or other matter, which may have accidentally entered, and to scrape and clean the turned and bored parts. The pipes are lowered singly, brought to the proper inclination, firmly bedded, and made to rest throughout their whole length on the solid ground. Every effort ought to be always made to lay the pipes in straight lines; but where slight deviations occur, the joint must then be run up with lead. Curved special castings have to be provided for the more important bends, as, for example, those of small radius, but plain socket-joints will do where the bend is sufficiently large. In regard to the pipe shown in fig. 2, after it has been properly cleaned and bedded, the turned and bored parts are paid round with good anti-corrosive brown paint of a proper consistency. The pipes are then driven together in a careful manner, the blows being directed all round the socket end of the pipe which is being driven, and repeated till it is quite home, but not longer. There is always an indication of this point in the driving, which experienced men recognise at once; but, the want of such recognition on the part of unpractised hands frequently gives rise to broken pipes. The driving-pipe is usually suspended by a stout rope from a plank supported over the trench upon two trestles, one on each side. Pipes and special castings, having wide joints for lead, shown in fig. 3, must have as much ropeyarn tightly driven into the socket as will leave a uniform space for lead all round, a width which is defined by the size of the pipe used.

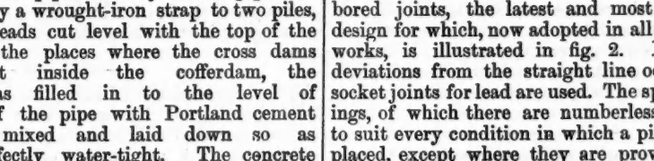


Fig. 3.—Wide Sockets for Lead Joints.

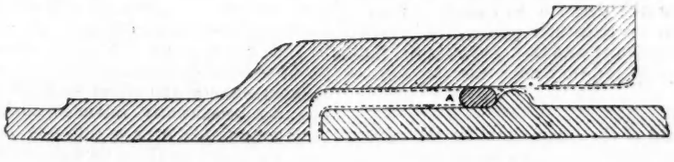


Fig. 4.—Socket for Rubber Ring Joint.

Diameter of Pipe.	Depth of Lead.
42, 36, 27, and 24 in.	3 in.
21, 18, 16, 15, and 14 in.	$2\frac{1}{2}$ in.
12, 9, and 6 in.	2 in.
5, 4, and 3 in.	$1\frac{1}{2}$ in.

A point of some interest, the facts of which are not frequently to be met with, is the amount of lead which a well-made joint will take. We give the weight in the case of seven of the most commonly-used pipes in the above list, viz., 36 in., 24 in., 15 in., 12 in., 9 in., 6 in., and 4 in., the weight of lead used for the joints of which should neither be more nor less than respectively 53 lb., $39\frac{3}{4}$ lb., 22 lb., 17 lb., $10\frac{1}{2}$ lb., 5 lb. 6 oz., and 2 lb. 14 oz. The lead is run into the socket by means of a clay fillet and jointed clasp ring, and the joint is afterwards neatly set up with caulking tools and 4 lb. hammers, and the joint left flush with the outside of the faucet; but a sufficient time must be allowed for the lead to cool before the joint is caulked up. In the case of lead joints being made in the turned and bored pipes, the whole space left for the purpose in the castings must be run up with lead, the joints, of course, being properly cleaned out before the lead is run in. Where flange-joints are adopted,—an expedient which is often necessary in forming a connexion with existing pipes, any length of pipe being easily obtained by the simple process of cutting them so as to make them fit in the required position. The carrying out of such a connexion is often of the greatest urgency, as a large portion of a town or city may be deprived of water until it is accomplished. The bolts used must be of the best iron, have square necks, and, usually, hexagonal heads and nuts are used; but the bolt must in all cases fill the nut. The joints ought to be made with flat-vulcanised india-rubber rings of good quality, always adopting the precaution of scraping the flanges clean before the joint is made.

Where pipes are laid of a larger size than those which may have existed in the locality, with the object of affording an increased supply of water to the district, it is often desirable to lift the old pipes, if in a sufficiently good condition, and relay them in another position. In the case of pipes with turned and bored joints, it is easy to remove them without cutting or otherwise injuring their joints, provided that the proper tools are used for the purpose. But in the case of the existence of lead joints, they must be melted out in the trench with as little annoyance to the inhabitants of the neighbourhood as may be possible. The pipes are then carefully lifted so as to avoid breakage, thoroughly scraped, and cleaned out inside in order to remove all rust, and then carted to the place where they are to be relaid.

The precautions which are usually resorted to in order to secure proper quality of metal, provide that the best grey metal be used, and under required conditions. The metal is remelted in a cupola, and at each casting a specimen bar and a specimen link are cast. The bars are 3 ft. 6 in. long, 2 in. deep, and 1 in. thick, which are placed on supports 3 ft. apart. They must bear a weight of 30 cwt., or 3,360 lb., in the centre without breaking. The links must bear a direct tensile strain of 7 tons on the square inch for twenty-four hours without breaking. These tests ought always to be made in the presence of the engineer or his representative. The casting of the pipes must be done vertically in dry sand, with the socket down. There must be sufficient head of metal to secure solidity, which head is subsequently cut off in a lathe. The pipes and special castings are then to be coated inside and out in a careful manner, according to Dr. R. A. Smith's patent process, applied at a proper heat; but care must be taken to have this accomplished before any rust sets in, and this often necessitates the coating being done before the pipes are proved; but, if they are proved before being coated, they must be carefully paid over inside with good raw linseed oil. The proof pressure generally adopted in

practice, though it varies with different sizes of pipe, is not always higher in case of increase of diameter, as will be seen from a glance at the following table, which indicates the particulars of the pipes used in the Blane and Endrich Valleys on the line of the Loch Katrine Aqueduct :—

Diameter of Pipe.	Thickness of Pipe.	Proof Pressure.	
		In vertical ft. of water.	In lb. on the sq. in.
48 in.	1⅛ in.	200	86¾
48 in.	1½ in.	400	173½
36 in.	1¼ in.	500	217
36 in.	1⅛ in.	400	173½
30 in.	1¼ in.	600	260
24 in.	1 in.	500	217
15 in.	⅞ in.	500	217

Each pipe is rapped with a hand-hammer from end to end while the pressure is upon it to discover whether there are any sandy, porous, or blown places.

It is important during the process of turning and boring that the pipes should be secured in such a manner in the boring-machine that they will remain perfectly cylindrical. One half-inch of clearance must be allowed for the driving, and, to test the accuracy of the boring tools, two pipes are usually driven together at frequent intervals, say every second day. The ends of the pipes without sockets are cut with a bevel, and the flanges of special castings are faced in the lathe. All the special castings are made 1-8th in. thicker than the pipes to which they are to be connected, and castings which are in any part 3-16ths in. less in thickness than that specified, ought to be rejected. It is not always possible to cast specials after the manner described for pipes in general, but they must, as far as possible, be cast vertically with the sockets down in dry sand moulds and with dry sand cores. It is of the greatest importance that the special castings as well as the pipes should be perfectly free from sand or air-holes, smooth both inside and out. The turned and bored fillets should project beyond the body of the pipe.

The sinking of the pipe tracks between Glasgow and Rutherglen, owing to the extensive mining operations carried on in the neighbourhood, gave frequent trouble in the form of blown joints upon the water-mains. To obviate this a proposal, illustrated in fig. 4, to adopt rubber-ring joints, shown at A, was carried out in the spring of the present year. The dotted line is intended to indicate the parts which were turned and bored to gauges. The only objection to the employment of it seems to be the probability in course of years of the india-rubber ring losing its elasticity, and this is a small matter when the convenience with which it may be renewed is considered.

NOTES.

THE *Manchester Guardian* states that a project for the formation of a ship canal from Boulogne to Paris has been laid before the Council Général of the Department of the Seine. The length of the line is stated at 187 miles, the capital required at 32,000,000*l.* This would give a cost of a little over 170,000*l.* per mile. The Suez Canal, in which there are no works of art of importance, with the exception of the piers projecting into the Mediterranean, cost 144,000*l.* per mile, to the end of 1882, for works, to which has to be added the further sum of 56,000*l.* per mile for financing, making altogether 200,000*l.* per mile. The traffic on the latter has increased gradually to a little under six million tons net, or eight million tons gross, measurement, making the entire transit of the canal in a year. The traffic estimated for the French ship canal is eighteen million tons in the year. The committee appointed by the Council Général to investigate the scheme have come to the conclusion that these figures have not a solid foundation; and being unwilling that the support of the authority in question should be given to an imperfectly-studied project, have recommended the Council to pass to the order of the day, which has been done accordingly.

THE question of the employment of colour in sculpture still continues to attract a great deal of attention on the Continent. One of the greatest supporters of the polychromatic theory is Dr. Georg Treu, Director of the Museum of Antiquities at Dresden, who is the author of a pamphlet entitled "Ought we to Colour our Statues?" a publication which has occasioned some sensation in art circles in Germany. Principally owing to the efforts of this gentleman the authorities of the National Gallery at Berlin have, we learn, organised an exhibition of painted and coloured plastic works. Their main object has been to familiarise artists and the art-loving public in general with all that has hitherto been attempted in this particular branch of art. The exhibition accordingly consists of a collection of examples of polychromatic sculpture belonging to all epochs and countries. The Berlin authorities have been very successful in obtaining from various museums, from public and private galleries, as well as from living sculptors, the loan of a number of exceedingly interesting specimens of coloured plastic work. Amongst them are plaster casts painted in oil, works in marble, slightly tinted, terra-cottas in all shades, and busts, composed of pieces of marble of different colours (the most detestable expedient, we may observe, ever employed to vulgarise a great form of art). Since it was opened this collection has been constantly visited by spectators, showing the extensive interest manifested in the subject.

THE Corporation of Preston appears to have been more energetic than wise. For some twenty years they appear to have supplied the district of Fulwood with water, although they had no statutory power to do so. This they did before there was any local authority with the power to give such a supply; and they did it with the licence of the Fulwood Local Board. But this Local Board has since obtained statutory power to supply the district in question with water. The result is a lawsuit between the Corporation of Preston and the Fulwood Local Board, the first stage of which has just been decided by Mr. Justice North. It was, we should have supposed, pretty clear, even without a judicial decision, that the Corporation had no right to act as they did; for, as Mr. Justice North observed, if they had the right to lay down water-pipes half a mile outside their boundary, there was really no limit to their local jurisdiction. Then, as to the argument that the Corporation had received an irrevocable licence from the Local Board, it was invalid of a Corporation to grant permission to do that which it had no authority to do itself; for it stands to reason that the basis of any authority at all was wanting. Consequently, also, the Corporation had no legal right to break up the streets of the suburb of Fulwood. It is much to be hoped that the decision will serve to remind all corporations that their powers are bounded by statutory limits, and that, even for the most laudable purposes, they must not step beyond them.

THE works of the competitors for the various medals and prizes awarded on "Commemoration Day" to the students in the schools of the Royal Academy were on view on Friday and Saturday last, in the galleries of Burlington House. The chief competitions for the gold medals, which are only offered in alternate years, are taking place on this occasion. We are glad to see an increase in the number of competitors in architecture, and that, though the subject, "A Town House," is a difficult one to treat, five out of the seven designs are of great merit, and one, at least, highly original, even to the verge of eccentricity. Entering the room there is first, on the left, a Renaissance design, the chief feature of which is an order of three-quarter columns, raised on a lofty basement, as high as, or higher than, the order. The basement contains the ground and first floors of the house, and the latter is lighted by a range of enormous windows, which, unfortunately, weaken the basement in appearance. The column on the angle in the upper part and the two nearly equal cornices are also points for criticism; but the beautiful frieze of horses and general harmony of the composition, aided by clever draughtsmanship, have combined to produce a fine and original design. Next comes a rather effective but fussy pile in a florid Renaissance, and then a clever design in the well-known style of a prominent architect, effectively grouped and drawn as to the perspective, in brown ink lines and washes. The influence of some architects on their pupils and assistants is remarkably exemplified in this design and the one first described. Crossing the room we come to a really fine composition in the François I. style, with high roofs and dormers, well planned and drawn and carefully considered in all its details. The next set of drawings reveals to the startled critic a house which must be intended for Cairo or Damascus,—which, by the bye, there is nothing in the conditions to forbid,—a highly original and certainly very clever conception, but the drawing, though refined, very slight and weak. The other two sets of drawings show respectively a design in good regulation Classic, with which it would be almost as difficult to find fault as it would be to praise it highly, and one in the regulation Domestic Gothic of a few years back, of which the kindest thing to suppose is that the author submitted it as a joke.

MR. MIDDLEWEEK'S paper on the housing of the poor, read before the Association of Public Sanitary Inspectors last Saturday, took up, among other points, the subject of overcrowding as the result of a necessity for the workman to live near his work, and urged the remedy which has been so much discussed, of the extension of living-ground out of London by the installation of a regular system of workmen's trains. Previous evidence in regard to this point shows that it is very doubtful whether this system would be accepted by the mass of artisans, or whether it could be made to pay. Mr. Middleweek also attacked the "model dwelling" system, on the ground that the rents were too high in such buildings, and that there was very little recreation-ground in connexion with them in comparison with the number of children who lived in them. The latter statement is certainly true, but it is connected with the former inextricably. The aim of most people who promote model dwellings is to make them remunerative at as low rents as possible. If more ground is taken, rents must be proportionately higher, unless the buildings are to become a mere charity establishment for finding people homes at rents convenient to their means. Like others who have written and spoken on the subject, Mr. Middleweek seems to ignore what is at the root of the whole difficulty, the fact that more people crowd into London than there is work and living for. To give exceptional advantages to these in the matter of rents, and to compel railways by law to run trains on other than remunerative terms to enable working men to live out of London,—these and other such propositions, however beneficently intended, and however they might tide over a difficulty in a temporary manner, would in the long run only tend to develop the evil of overcrowding and pressure on space in London in more formidable dimensions.

THE Société Centrale des Architectes, at its general meeting on Sunday, the 6th inst., elected its officers for the year 1886 as follow :—M. Bailly, member of the Institute, president; M. Hermant, vice-president; M. Wallon, principal secretary; MM. Monnier and C. Bernard, assistant secretaries; M. Paul Sédille, keeper of the records; M. Lesonfaché, treasurer; MM. Questel (member of the Institute); Alfonse Normand and J. Heinard, censors. At the previous meeting the Archæological Commission nominated and caused to be elected Messrs. I'Anson, of London; Strohm, of St. Petersburg; and Da Silva,

of Lisbon, corresponding members of the Commission. The Council of the same Société, at its meeting on the 2nd of December, on the proposition of M. César Daly and other leading members, unanimously elected Mr. George Aitchison, Mr. R. P. Pullan, and Señor Mariano Belmas, corresponding members. Señor Belmas is secretary of the Spanish Society of Architects, Architect to the Public Works Department in Spain, and director of the "Revista di Arquitectura"; he is also an honorary and corresponding member of the Institute of British Architects.

THE paper read before the Edinburgh Architectural Association, on the 3rd, by Lord Dean of Guild Gowans, "On the Maintenance of the Health of the People and the beauty of the City," contained much that was both true and well put. We observe the speaker commented on what we have several times drawn attention to, "the mistake of closing-in the angles of ground laid out for tenement houses," a remark which applies equally to quadrangular arrangements in public buildings. In regard to the beauty of the city, Dean Gowans regrets the introduction of brick and cement in Edinburgh, as showing a tendency to partially displace the stone architecture. In regard to the sanitary portion of the paper, we may quote the following as specially deserving of attention :—

"At our pit-heads and in our paraffin works, where there is always abundance of heated water, why should there not be baths for the use of the men, who, from the nature of their occupation, get soiled and begrimed, and who, from the want of such accommodation, have to find their way home more akin to animals than human creatures, and in this state have to enter among a family crowded into a single apartment, where there are no facilities for attending to what would not only refresh their bodies, but give comfort to their whole household? I would even go a little further in regard to this, and suggest that the men whom I am alluding to should not only wash and refresh themselves by free use of water at the works, but might, with little trouble to themselves, and certainly with great personal pleasure, have clothing suitable, which could be kept there, while comfortable and cleanly apparel could be put on for use in retiring to their homes."

THE Académie des Beaux-Arts, in a nearly full meeting (a thing of rare occurrence), on the 5th instant, elected Baron Alphonse de Rothschild an honorary member by twenty-seven votes against twenty given to M. Duplessis.

THERE is to be open shortly at Aberdeen a Winter Exhibition of Art and Industry, including loans from the national Exhibitions, work by leading manufacturers in china, pottery, glass, tapestry, embroidery, iron work, &c.; and loans from private collectors. The Exhibition will be held in the Aberdeen Art Gallery and Industrial Museum. We have reason to think the exhibition will be a very good one.

IN respect to the judgment of Chancellor Espin, granting a faculty for erecting chancel-gates in a church near Liverpool, which we recently noted (p. 745, *ante*), a legal correspondent writes :—"The Chancellor endeavoured to restrict the importance of the judgment by stating that the case was not to be regarded as a precedent. But to say a case is not a precedent cannot make it less so if it is one. The Toxteth Park case seems to be an example, at any rate, that Chancellors may grant faculties for chancel-gates to protect the chancel (this having been the main reason alleged), and we are not aware of any reported decision to the same effect. Of course, the decision of a Chancellor of one diocese does not bind another Chancellor as the decision of a Court of Appeal binds an inferior judge. But it does set an example which may induce other Chancellors to act in the same way, and it undoubtedly helps to direct the judgment when similar cases arise. In the present case, the gates were 4 ft. high, measuring from the nave, which shows they were a real protection against careless persons, at any rate."

IN a letter in the *Times* of the 4th, Mr. John Bickerdyke calls attention, in reference to the sad accident at Osney Bridge, to the desirability of examining the state of the bed of the river adjoining the piers of bridges after floods on the Thames. The scour of the water through the narrow arches of many of the bridges on such occasions must often change very materially the state of the ground adjoining the foundations of the piers, and though we know that bridges ought to be so founded as to be independent of such effects, and that all modern bridges built by competent engineers are so, we have not the same certainty with regard to some of the older Thames bridges. Is the state of their foundations periodically examined? It should be, in the case of railway bridges especially.

FROM Paris we hear that M. Muntz, the keeper of the library and collections of the École des Beaux-Arts, in resuming, on Wednesday, the 2nd inst., his course of lectures on æsthetics, treated, before a numerous audience, the subject of the history of art in the fifteenth century, especially of Flemish art, its sources and successive developments, and the influence respectively of Flemish and Italian art at that epoch. This lecture was an introduction to the annual course; it was of great interest, and met with deserved success.

A CORRESPONDENT has brought under our notice a new idea in regard to decorative surfaces and backgrounds, by the use of tarnished silver surfaces, which give a brilliant coruscation of rich colouring of an apparently permanent nature. The panel we have seen had a floral design painted over part of the surface in ordinary pigments, the rich colours of the tarnished metal producing a brilliant background; but it is also suggested that the metal may be used in panels as a decorative surface in itself, just as coloured marbles are used. The panel shown to us had been executed, we understood, for three years, and had not altered in any way. The result was novel and very effective, and the idea seems worth consideration.

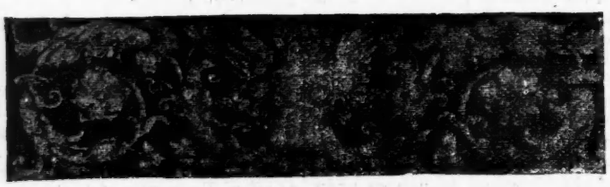
FROM a report in the *Birkenhead News* (Dec. 5), it seems that there has been something rather unsatisfactory in the proceedings in reference to the Birkenhead Abattoirs competition. It would appear that Alderman Mills and Alderman Walker had been appointed by a resolution of the Committee to report on the plans, and had selected three as in their opinion the best, but at the suggestion of the Committee they had allowed a fourth set of plans to be retained among the number recommended, which set, signed "Efficiency and Economy," had been placed first by the Committee, and were formally recommended for adoption by the Town Council under the names of their authors, Messrs. A. Bleakley, T. W. Cubbon, and C. O. Francis. The designs were sent in under mottoes, but these names were announced before any formal decision had been come to by the Town Council. Asked by Alderman Walker how they came to know the names before the decision was formulated, a member of the Council said that they had made up their minds before they sent to the Town Clerk for the letter containing the architects' names. The Town Clerk "regretted" that this had occurred, and the Mayor said it was "very unfortunate"; but as it appears that the authors of the design are Birkenhead men, and as another Councillor said he supported the committee partly because the successful architects belonged to Birkenhead, "and it was likely to give some employment to people in the borough," it is not very difficult to read between the lines of these virtuous regrets. Aldermen Walker and Mills (who, we believe, are both architects) said that their recommendations had been pooh-poohed, and suggested that an independent professional opinion should be taken, but it was replied that it was unnecessary to pay twenty or thirty guineas for an opinion, when they were quite competent to form one themselves. Alderman Walker said "the whole business savoured very much of jobbery." Most people will agree with him.

IT is rather a natural "rider" to the subject of this last note to observe that the Hon. Secretaries of the Institute Competition Committee, Mr. Cole Adams and Mr. Aston Webb, wish it to be known that "they will be glad to afford Promoters of Competitions any assistance in drawing up their conditions." We wish promoters of competitions would avail themselves of it, for in general conditions of competition are drawn up in the most vague and irregular manner, even in regard to the primary object of conveying the meaning and wants of the promoters to the architects. But, as part of the result would be to increase the difficulty of the little friendly arrangements of "local option," perhaps many of the promoters will not be enthusiastic on the subject. They must remember, however, that a great proportion of the best class of the architects have bound themselves to enter no competition except under certain conditions, so that if they choose to frame conditions at their own sweet will, they can only have a limited field of talent to select from.

EXCAVATIONS IN ASIA MINOR.

ON Thursday, the 3rd inst., Mr. R. P. Pullan read a paper before the Royal Archæological Institute of Great Britain and Ireland, on his recent excavations in Asia Minor. The western coast of this country is remarkable for its geographical formation. It is indented by immense gulfs, with peninsulas of corresponding length. The gulf of Kos, for instance, is about ninety miles in length, and the peninsula of Cnidos is of similar length, while at the widest part it measures only about ten miles across. There are but three rivers of any importance: the Mæander, the Hermus, and the Cayster. These run through wide plains covered by alluvial soil, brought down by the gradual process of denudation, from the adjacent ranges of Mount Latmos, Mycale, and Tmolus. Mr. Pullan said that he had explored the coast from the borders of Caria to the Dardanelles, a distance of between 300 and 400 miles, proceeding sometimes by carriages and sometimes on horseback. With the aid of a map he described his journeys to Ionia, Lydia, Æolia, and the Troad. At Pergamos, he had seen upon the Acropolis traces of fine sculptured marble on the spot where the German expedition had lately disinterred the large altar of which casts are to be seen in the collection at South Kensington. In the course of his exploration he had visited the sites of the Temples of Apollo Branchidæ, near Miletus; Athene Polias, at Priene; Diana Leucophryne, at Magnesia; Mæandrian Cybele, at Sardis; Apollo Smintheus, in the Troad; and that of Dionysus, at Teos. Mr. Pullan subsequently had charge of an expedition for the excavation of the Temples of Teos, Apollo Smintheus, and Athene Polias, for the Dilettanti Society. These operations were carried on successfully at various intervals during a period of ten years, and resulted in the discovery of certain data for the restorations of these buildings, which were published in the fourth volume of the "Antiquities of Ionia," by the Society of Dilettanti, and in the exhumation of numerous inscriptions and pieces of sculpture which are now deposited in the British Museum, where they may be inspected by those who are interested in them. The paper was illustrated by a large collection of views, some of which were selected from those now being exhibited at the Burlington Fine Arts Club.

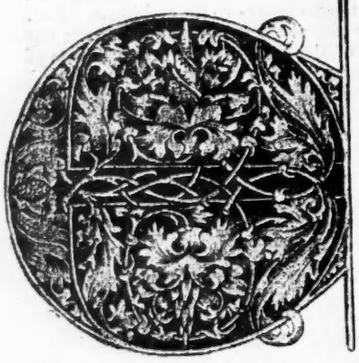
New Public Abattoirs, Birkenhead.—At a meeting of the Birkenhead Town Council, held last week, the Markets Committee unanimously recommended that the designs under the motto "Efficiency with Economy," submitted in competition for the new public abattoirs to be erected in New Chester-road, be adopted. This resolution, on being put to the vote, was carried. The authors of the selected designs were found to be Messrs. Alex. Bleakley, A.R.I.B.A., Thomas Cubbon, and C. O. Francis, of Birkenhead. The estimated cost of the building is 7,000*l*. We have referred to the matter under the heading "Notes."



THE DECORATIVE WORK OF THE EARLY GERMAN ENGRAVERS.*

PART II.

ALBERT DURER AND HIS FOLLOWERS.



ENGRAVING once firmly established as an art had not long to wait for the appearance of its greatest master. The work of the earliest masters had been so excellent that there was but a short stride to be taken to reach the summit of perfection. That stride was soon taken, and the summit reached, by Albrecht Dürer. It is strange, however, that he does not appear to have paid any serious attention to the production of ornamental designs. It is the more curious when we remember that he was still a young man when Israhel van Meckenen died, and that he certainly was well acquainted with, if not influenced by, the work of that master; neither could he fail to have been impressed with the beauty of his designs. Nor is the absence of pure ornamental work from Dürer's hand to be accounted for by the fact that he was not a goldsmith, for, as Professor Colvin has pointed out, one of the greatest uses of engraving was to furnish ready-made compositions to artists who had not much inventive faculty of their own; and if the engraver worked for the artists of all kinds, he would also be employed by the uninspired metal-workers.

There are, however, six very curious designs by Dürer (*dedales*, labyrinths, Bartsch calls them) for embroidery. They are in that twisted, knotted style so dear to broderers, the braid being laid on the ground-work, and twisted and turned about in regularly repeated contortions till the whole of it is covered without a break in the line of the pattern. These designs are circular, about 8 inches in diameter, the pattern being cut and left white on a black ground. There is an escutcheon in the middle, and, being on a square plate, the angles are filled up with a small leaflet bearing a fragment of the original pattern. They are hardly of sufficient interest to warrant the reproduction of any of them; they show, however, that Dürer was a master, at least, of the intricacies of construction in design, and, so far, they are masterpieces. He also seems to have been the parent of those extraordinary caligraphic mysteries which even yet delight the hearts of masters of penmanship. About thirty of these have been reproduced by Obernetter, of Munich.

We now arrive at the group of engravers known by the name of "The Little Masters." They were the immediate successors, followers, and imitators of Dürer, but none of them rose to his excellence in pictorial work, although their decorative work is much of it exceedingly good. Their reverential imitation of the great master was carried to such an extent that, where good fortune allowed them to use a capital A, they invented a monogram closely resembling his.

The first of these masters is Albrecht Altdorfer, of Ratisbon. He has left twenty-three studies for vases, which, taken together, merit Professor Colvin's encomium that they are "in an excellent and refined taste." We said at the beginning of our paper that occasionally we should be compelled to differ from that eminent critic, and we have now come to one very great divergence of opinion. In studying these cup designs, we had noted them as nearly all deserving of praise, some as of great excellence, but two as hopelessly bad, both in form and design. In our after-reference to the Professor's papers in the *Portfolio*, from which, as we have already acknowledged, we have culled much valuable information, we found these two unfortunates held up for especial praise: "one of them a vase with a pattern of shells, and another with lilies of the valley, being as beautiful as any inventions of their class." We fear that we must abide by the opinion contained in our notes. In fact, we find it very difficult to think which is the uglier or the worse designed. In the shell pattern (B. 81) there is little or no attempt at beauty of form or design, the bosses are simply covered with ugly shells, the engraving showing that the workman was to get them as near to nature as possible. To the lily of the valley pattern (B 94), the same remarks apply. The surface of the cup is formed into slabs, arranged tile-wise, one overlapping the other, each slab bearing a sprig of the natural flower. As a general rule, however, a good and not over-modelled acanthus-leaf is used to decorate the surfaces. One of them (1,079) is of very great excellence, and worthy of reproduction (fig. 10).

It is a curious feature in certain stages of all styles of decorative art, this jumble, this mixture of representative with decorative work; it was already noticeable in the austere work of missal painters during the last years of the fifteenth century. Owen Jones has figured some curious specimens of it in plate LXIII. of his

Fig. 10.

"Grammar of Ornament." The painter seemed unable to restrain his work within the limits of the art he worked in; because he was able to paint a flower or a bird, he must needs introduce them on all occasions; till at length, in the midst of conventional scrolls, we have birds, beasts, fishes, and flies flying about flowers and trees, which have their shadows too, and are made to "look as if they grew there." We have already pointed out how the early designs of Israhel van Meckenen were disfigured in the same way, and how in his riper experience he shook himself free and went back to the pure spirit of Gothic design; but this panel of Altdorfer tells a different story; it is of the highest excellence as a piece of engraving and in the fundamental arrangement and flow of the lines, but the vicious style is adopted when the master is at his best. The gradual decline of decorative art has at last come to an end, for it has reached the lowest depth of debasement. The lines of demarcation between representa-

Fig. 11.

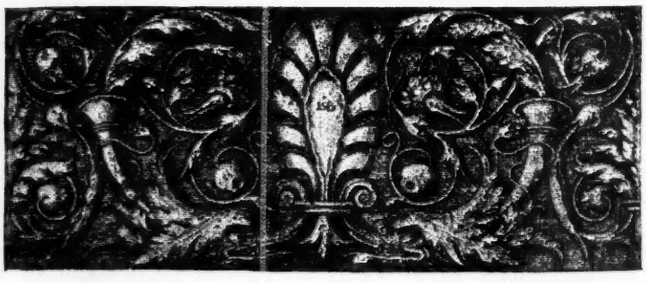


Fig. 12.

* See p. 783, *ante*. The initial letter is from Van Meckenen's alphabet, mentioned in the previous article.

tive and decorative art had been steadily getting hazier and hazier, till at length they had altogether vanished, and were no longer recognised. Then came the study in Rome of the great antiques lying only beneath the surface of the soil, and with it the Renaissance of art. One is constrained to dwell for a short time on this great epoch in the history of the arts. Sir Digby Wyatt has truly said that, in its earliest stage, the Renaissance of art in Italy was a revival of principles; but had that revival had its origin in the discovery of Greek antiques, the result would undoubtedly have been a much better and more exalted style. The Roman models themselves had ceased to be perfect, had fallen somewhat away from the purity of Greek design, though much that was very good remained. Tangential flow and the equal covering of spaces were still the first principles on which

Fig. 13.

the great rolling curves were drawn, but in the conventional treatment of the acanthus-leaf the later workmen had overmodelled the surface, and while still retaining a conventionalised outline, had gone nearer to a faithful representation of the natural modulations of the leaf. This indecision was the blemish of the work which was to exercise so great an influence on the world's art; and, unfortunately, the style it was set to reform itself had developed such a craving after natural form, that it had ceased even to be a blemish, it had almost worked its ruin. Thus it came to pass that the Italian designers, working

Fig. 14.

on the new scheme, while they came back once more to flowing tangential lines and evenly covered spaces, and adopted many of the Roman conventional forms, could not altogether reject their hankering after nature. The best of the Renaissance designs are very far from perfect: there are many good acanthus scrolls, and many new forms based on other leaves and flowers, but there are also, as essential ingredients in the design, tragic and comic masques, musical instruments, semi-Priapal terminals, antique altars, tripods, and vessels of libation, dancing *amorini*, and hybrid marine monsters and chimeras."

Professor Colvin has traced with consummate skill the influence of the Italian masters on

Fig. 16.

Fig. 17.

Albert Dürer and his followers; we are, therefore, not surprised to find in their work friezes and panels designed in the spirit of the Renaissance. But in what we have said of the revival, it must be remembered that into whatever country it travelled, the new spirit did not efface, but merely worked on the old spirit; where that old spirit was very debased the result was still infected with weakness: where it had signs of

Fig. 15.

power much better work resulted. Thus, in Italy, we find perhaps the weakest of all Renaissance ornament; but in Germany the Gothic influence was still alive, and therefore it is, we think, that in the late work of these German masters we find a much more vigorous Renaissance ornament,—the design, both in construction and conventionalising, still bearing the impress of the influence of Van Meckenen's genius. Let us, at the risk of reiteration, once more point out the difference between the principle involved in the introduction of real objects in the designs of the earlier, and that in those of the later masters. In the former they were used in one of two ways: either pictorially, the pure decoration being introduced as a framework, and being independent of them as a part of the designs: or as part of the designs, filling up awkward spaces, but still without entering into its construction. In the latter they formed the main feature of the design, which was constructed upon them as a basis. What was a weakness therefore in the one was a strength in the other. This strong point in the Renaissance, however, very soon showed signs of decay: the canons of decorative art were soon abandoned, and then it was that all sorts of objects treated naturally were mixed higgledy-piggledy into the conventional leaves and flowers of pure decoration. There are two Renaissance panels by Altdorfer well worthy of attention (pp. 106, 107); one of these we engrave (fig. 11).

After Altdorfer comes Hans Sébald Béham, whom, with his brother Barthélemy, Professor Colvin ranks as the most accomplished of the Little Masters. Sébald executed a large number of decorative works, chiefly friezes and panels (one of which we have placed at the end of this article): several designs of no very great merit for the heraldic *entourage* of coats of arms, and a few cups which cannot be considered very beautiful. Many of the friezes are classical studies of pure figure work, and the decorative ones are without exception in the Renaissance style, with usually the human form as the mainspring of the design: two of his best works are, we think, a small panel (B. 235), called by Bartsch "Les Deux Têtes de Poisson" (fig. 12). There are also worthy of note four upright panels (B. 243—6), in which the central ornament is the vase so characteristic of the Renaissance; but the scroll and foliage work is very fine.

Of Barthélemy Béham we need only notice one small panel (p. 73), which we engrave (fig. 13).

Jakob Binck, like the Béhams, was completely imbued with the spirit of the Renaissance, his designs being full of vases, nymphs, and little naked boys; but his foliage is excellent, as the accompanying engraving testifies (fig. 14). He also made several designs for the sides of dagger-sheaths: they are 6 in. high by about ¼ in. in breadth at the base: the upper half is usually devoted to a figure, the lower to a support of decorative foliage. The one we engrave (p. 126*a*), "Le Soldat à la Gourde," is a very fine example of this form of design (fig. 15).

The master of the monogram I. B., worked much in the same groove as Jakob Binck; the frieze of which the subject is two men trying to break a vase with massive clubs (B. 45), which is engraved at the head of the first part of this paper (page 783, *ante*; described by error in the foot-note there as the work of Barthélemy Béham), is fine of its kind. We suppose the absence of lower extremities incapacitated them from keeping steady enough to deliver very accurate blows, as the vase is not cracked anywhere that we can see. Another small panel (B 39), a torso, with foliage springing from it, is exceedingly graceful; the foliage, however, is even more realistic than usual (fig. 16).

The few designs that come from the hand of George Pencz may be passed over as being devoid of any great merit.

Lukas van Leyden was, as his name implies, not a German, but a Dutchman. He is, however, not unfrequently grouped with the Little Masters, and one of his studies being very remarkable, we have ventured to include his name among the German masters whose work we are considering. In his arabesque panels, two of which we engrave (figs. 17, 18), there is a tremendous amount of human form, but there is a very great charm about the conventional detail.

The plate to which, however, we would draw special attention is (B. 163), containing two very graceful studies for scrolls (fig. 19). They deserve very careful examination.

We have left till the last one of the most prolific of the Little Masters,—Heinrich Aldegréver,—whose work is, after Israhel van Meckenen's, we think, the most interesting of these German engravers. In his decorative work there are two very strongly-marked styles; the first which comprises all his early work is pure decoration, being designed in the spirit of Van Meckenen, but in which a simpler leaf-form takes the place of the acanthus; the second seems to have originated about the year 1529, and is, of course, Renaissance wedded to the first style. His designs are not all dated, but all, we think without exception, in the Renaissance style bear that or

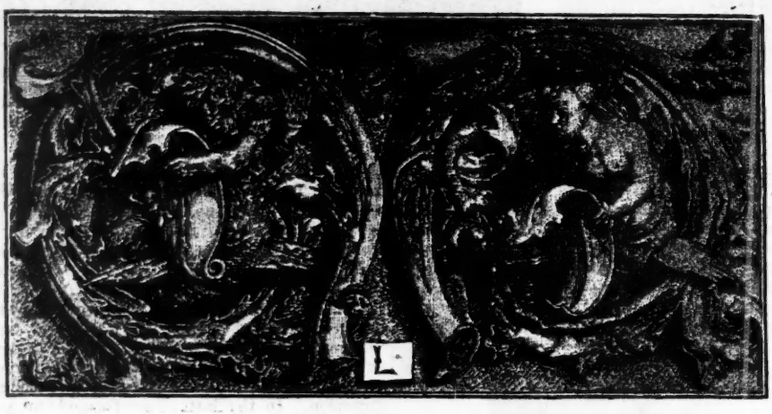


Fig. 18.

It would seem as if the master had been anxious to compare the old with the new style of decoration, to see what could be done without birds, beasts, and fishes; and in truth, with the exception of the too realistic stem, he has succeeded in the old style without those incumbrances, better than in the new. The wave of the upper scroll is good, but of the most ordinary type; but in the lower one the flow of the main stem is a masterpiece of inventive skill. The scroll in which the foliage works, though based on the simple form, does not adhere rigidly to it, but the trunk itself branches out into a second scroll of double wave length (to use a scientific expression), the whole being a piece of construction which we think has hardly ever been equalled, certainly never surpassed.

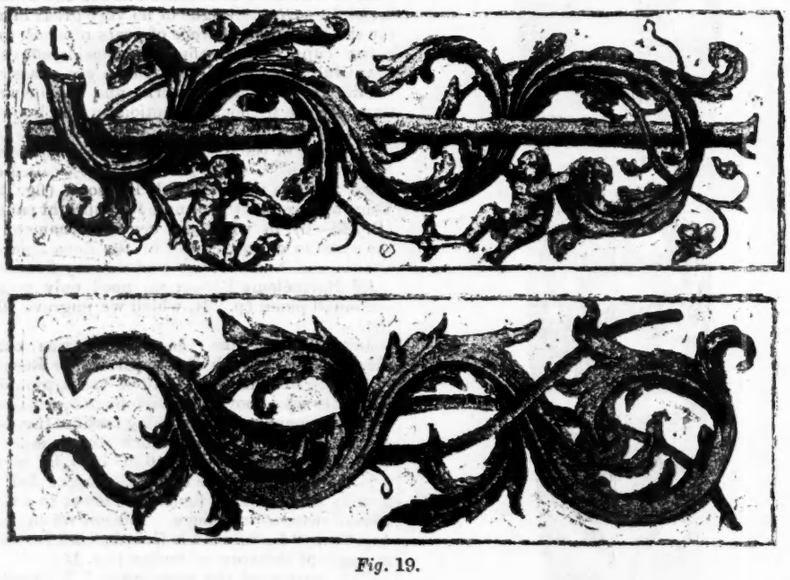


Fig. 19.

In many of the friezes of Virgilius Solis we find a new idea; the animals are, as usual, perfectly natural, but the decoration instead of working out of the hair or tails of them, is in simple outline shaded in straight lines, and forms a background. In three of a series of four medallions (B. 463 *et seq.*), there is a very marked advance on the work of his predecessors, the main feature of the design ceases to be a wild man or beast, but is a carefully devised pattern of the style which characterises English Elizabethan ornament. The fourth of the series, however, is sadly marred by the branches of realistic flowers and fruit.

a later date. He did not, however, entirely forsake his first method, but seems frequently to have reverted to it, more especially when he had to work out sets of designs. In a set of dagger-sheaths, two will be in the first and two in the second manner. Of these sheaths, as well as of hilts, there are a great number of plates, and they are all marked by the same exquisite flow of curve and well-balanced foliage.

The scabbards of the daggers are nearly all designed after the model of Binck's "Soldat à la Gourde," the top part being a figure standing on a scroll of ornament. The figures themselves are excellent, but of the ornaments it is impossible to speak adequately. Whether in pure ornament or in Renaissance, there is the most wonderful command of flowing curved lines, and in the construction of the design he never repeats himself, every one comes fresh from his hand stamped with the mark of his genius. The one we engrave (B 261) is a wonderful specimen of his power (fig. 20). Observe how gracefully the central sprays stand, and how beautifully another winds round them, droops, then raises its head again. The leaf-form which the master has adopted is, perhaps, not so majestic as the acanthus, but it is singularly graceful in its simplicity. Its outline is strictly conventionalised, and the engraving shows no exaggerated surface modelling. Another very charming scabbard we can do no more than refer to by its number; it is B. 215, but, indeed, a little study of the whole series would do much to improve the metal work of the present day. Of his innumerable friezes and panels we select four, three of which are in his best Renaissance style:

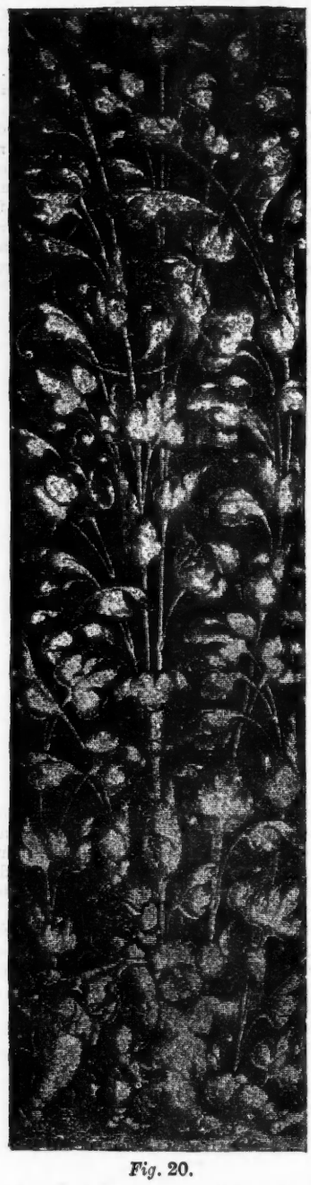


Fig. 20.

B. 245 is the head-piece to this part of the paper, the others (figs. 21, 22, and 23) are B. 197, B. 202, and B. 256.

Fig. 21.

We live in an age quite given over to decorative art in some form or other, good or bad; and yet we feel that the reader will have been very patient with us if he reads down to

these last words, not only because of the difficulty of transcribing lines into words; but also because this age, although quite given over as aforesaid, is not a little apt to take what is given to it without caring for too deep an examination into its references as to character; or, because the persons who live in it are not a little apt to rest satisfied with their own notions as to what is good and bad in art; or not a little apt to think that "so long as a thing is pretty" the principles of the art of decoration are barely worth discussion. Some form of decoration has been cultivated by all people in all ages; the forms which have been adopted at different epochs, and by different nations, are of course infinitely varying. On this account, therefore, it may seem almost presumptuous to talk of the canons of an art which so many have practised for their delight so variously. But whether we look at the earliest or the latest works of savage tribes; at the productions of the civilised ancient or modern; whether we study the designs from the East or from the West, it is certain that through them all certain rudimentary principles have been recognised and acted on to the best advantage,—that is, with the most pleasing result. Such universal principles are legitimately called the canons of the art to which they are applied. Decorative art had, indeed, been practised long before the discovery of engraving; we have here, however, a new body of men taking to it and elaborating it for the benefit of the trade in which they worked. In the plates which have been reproduced, we have endeavoured to select such as will show best the history of the development of the art among its new professors; and we think this history is remarkable in illustrating the way in which *rudimentary essential* principles force their way to the front, and claim the attention of those who are devoting themselves to bringing any branch of art-work to perfection. That some of these German masters attained perfection we think cannot be denied; to some, a second rank can only be accorded; but they all must have worked very lovingly at their plates, and we have spent a little time in very lovingly studying them, that this branch of their work might not be wholly given over to neglect.

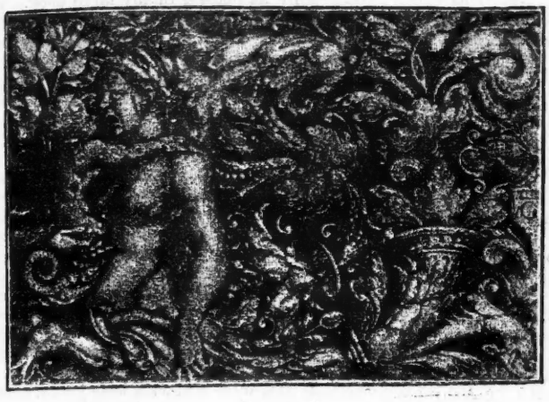
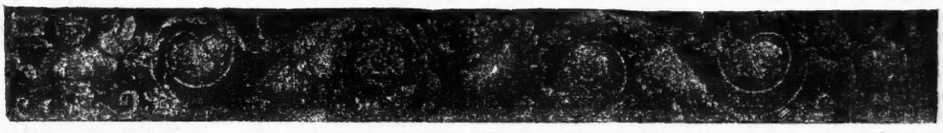


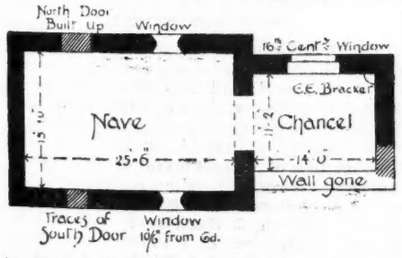
Fig. 23.

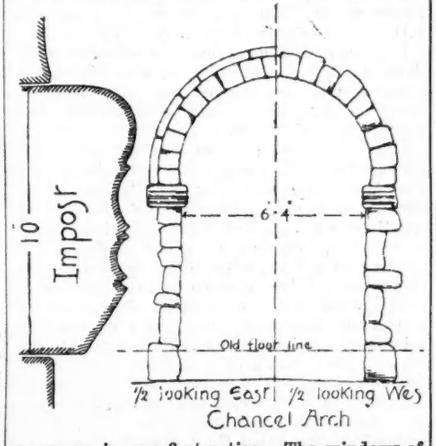
Fig. 22.



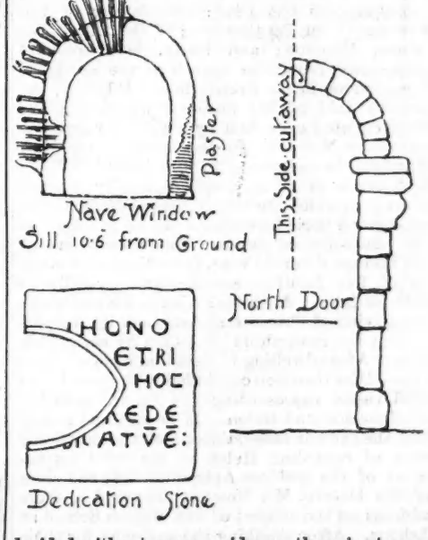
THE NEWLY-DISCOVERED SAXON CHURCH AT DEERHURST.

WE are now enabled to reproduce the plan, as far as is known at present, and some of the details of the architectural and epigraphical points of interest of the newly-found Anglo-Saxon Church at Deerhurst, of which we laid a general notice before our readers on the 21st of November last. Since that article was in print, Mr. John H. Middleton, M.A., F.S.A., read a paper on the church, and exhibited some drawings and a squeeze of the "Odda Inscription" at Oxford, before the Society of Antiquaries, which has increased the interest already felt by antiquaries and architects in this remarkable building. The plan has not been hitherto published, and we are glad to be able to give a sketch of it, which will enable those who read our notice to follow the measurement and outline then described. One feature in the walls, which are constructed of thin pieces and slabs of the local blue lias, with a very large proportion of mortar, deserves mention; it is the excellence and solidity of the ashlar work at all the angles, which are five in number, the only one destroyed being that at the south-east corner of the chancel. The work of these is admirable, being wrought in large stones. This is all the more curious as none of the Saxon angles of the larger church not far from this one are worked in ashlar, although it is used in some of the jambs of the many doorways and window-openings of that edifice. The whole building was originally plastered thickly, both inside and out, with hard white stucco. The drawing of the chancel-arch is the best that can be given at present, as the jambs, but not the arch itself, are still concealed from view on the nave side, by reason of the floor of the room, where the brick pier and wall remain *in situ*, as in the accompanying sketch. The details of the chancel-arch are very important factors towards determining the true date of this ancient building. They certainly bear little resemblance to anything of the kind in the larger church, and as the impost is the only ornamental feature in the whole building we must naturally look to it for the solution of the question of date examined in the light of existing remains. There can be little doubt, however, that the architectural evidence will be found to agree with the testimony of the ancient literary records, of which we gave a summary in our first notice. The windows of this church, according to Mr. Middleton's belief, were probably open to the air, and in all probability were furnished with osier wattle-work or screens, as has been observed in other instances; a portion of the oak lining to the head of the only original window, of which we here give a sketch to show the arrangement of the slabs in two concentric arches, roughly set in the copious masses of mortar which comprises more than half the contents of the walls, has been found in its original position. The north door bears a general similitude to the chancel-arch, but has not been furnished by the original sculptors with so elaborate an impost, although enough remains, both of jamb and voussoirs, to show, by the arrangement of the stones, the wide joints and other details, that the door and the arch of the chancel are contemporary with the edifice itself.





The inscription has led to some ingenious attempts at restoration, and it has been suggested that it may be read:—"+In hono[rem Sci P]etri apl'i hoc [altare] rededicatum est," instead of the reading:—"+In honore Sanct[e Tri]nitatis hoc altare dedicatum est." This, of course, is a point which cannot be satisfactorily decided without more evidence than is at present available. The palæographical interest lies in the shape of some of the letters, and the square C certainly points to a possible early date, as those will not fail to observe who are able to inspect the somewhat similar dedication stone of St. Paul's Monastery at Jarrow, figured in the extra "Winchester volume" of the British Archæological Association, p. 441. Now that the Ecclesiastical Commissioners have given permission to the Society for Preserving Ancient Buildings to restore this chapel at



the Society's own cost, we feel certain that none of those ancient features described above will be deteriorated, and we can only hope that the very moderate sum of money likely to be required, about 100*l.* or 120*l.*, will be raised without difficulty or delay. On the east side, the picturesque half-timbered Tudor house, which has been incorporated, or, so to speak, grafted upon the chancel walls, the north and east of which have been lowered, so as to run only to the level of the floor above, and cut away altogether on the south side (see plan) to suit the house, will remain, as it now stands. It has good details, and may be made serviceable; far from being detrimental to the adjoining chapel, it will serve to keep it protected from the weather, and set off its archaic characteristics. The Commissioners are now putting this house in order. The range of buildings on the western side require removal, and this will probably be carried out, as the Commissioners are willing to allow them to be taken down.

GREEK VASE PAINTINGS AT THE SOUTH KENSINGTON MUSEUM LECTURE THEATRE.

On Wednesday last Miss Jane E. Harrison finished her course of lectures on Greek Vase Paintings. The lectures have been interesting in the highest degree, from first to last, and admirably delivered, and Miss Harrison powerfully unfolded the whole tragedy of Troy from the day of the fateful Judgment of Paris down to "the night of Troy's last agony." Perhaps, however, the most fascinating of the lectures were the fourth and fifth, which treated of the exploits of Achilles before Troy. On the same François vase on which is represented the marriage procession of Peleus and Thetis, is also depicted the first ruthless act of their son, the slaying of the young Troilos, as he came to water his horses at the spring sacred to Apollo. Few vase-paintings deal with the subjects of the Iliad itself, and they are chiefly concerned with the embassy to Achilles, in Il. ix., with the merciless dragging of the body of Hektor by Achilles round the tomb of Patroklus, and with the ransoming of the body of Hektor. For the last incident Miss Harrison showed not only vase-paintings, but a most interesting piece of archaic work, a bronze mirror from Olympia, where the scene is treated with the most perfect simplicity, after the severe, condensed manner of the Peloponnesian school. The aged Priam touches the chin of Achilles, in the regular attitude of Greek supplication. Behind is Hermes, to show that the event took place by the will of the gods; on the ground the body of Hektor. Many beautiful vases illustrated the career of Achilles subsequent to the Iliad: his slaying of the Amazon queen, Penthesileia; of the Æthiopian prince, Memnon; and lastly, in a splendid paraphrase from the speech of the shade of Agamemnon in the twenty-fourth Odyssey, the lecturer told of his untimely death, and the dirge chanted over him by his mother and her attendant Nereids. In the last lecture, Miss Harrison, in reference to the legends of the destruction of Troy, dwelt especially on the manner in which the larger compositions of the red-figured period were built up on the lines of the black-figured types. The decorations of the famous Vivenzio vase, from Naples, is made up of five familiar archaic groups,—Æneas with his father, Anchises; Ajax and Kassandra; the slaying of Priam and Astyanax by Neoptolemos; the recognition of Aithra by her grandsons. After dwelling in detail on each of these types, Miss Harrison concluded with three beautiful vases, representing the fateful meeting of Menelaos and Helen. It is pleasant to find that the ancient vase-painter took the chivalrous view of regarding Helen as the blind instrument of the goddess Aphrodite. At the close of the lecture, Mr. Newton delivered a short address on the subject of the British School at Athens. After thanking the audience for their hearty support of an object of national interest, he sketched the progress of the school from its first formation at Marlborough House in 1883. A building site has been granted by the Greek Government, and the building is progressing under the direction of Mr. Penrose; but funds are sorely needed for the founding of a library and the endowing of a director. Mr. Newton concluded with the interesting statement that, according to Byzantine tradition, the true Palladium of Troy, with which the fortunes of Rome were inextricably bound up, now lies buried at the foot of the so-called Burnt Column at Constantinople. Should that city fall into the hands of Western conquerors this ancient Palladium might once more see the light; and in that case it was to be hoped that such an able lecturer as Miss Harrison may again discuss both the literary and artistic traditions which have come down to us of the Story of Troy.

After the paying of expenses, 87*l.* have been cleared for the fund for the British School of Archæology at Athens.

A NEWLY-DISCOVERED ROMAN VILLA AT YATTON.

The Rev. Prebendary H. M. Scarth, M.A., F.S.A., rector of Wrington, near Yatton, Somersetshire, whose recent work on Roman Britain has done much to disseminate an accurate knowledge of our history under Roman domination, laid before the Society of Antiquaries on Thursday, 3rd inst., a short paper descriptive of the recently-discovered Roman villa at Wimberham, in the parish of Yatton, about twelve miles to the south-west of Bristol and seven miles north of Axbridge. This parish is watered by the River Yeo, which, after lending its name to Yeovil and Ivelchester or Ilchester, runs into the Bristol Channel and forms part of a plain extending nearly to the banks of the River Severn. The surface is generally level, except in the district of Cleeve. Close by, on the east, is the celebrated pre-historic fortress known as Cadbury Camp. The villa was discovered during the progress of some drainage works. The walls run up the river bank, and ten apartments have been traced, comprising six tesselated pavements, which have now been judiciously covered over with sheds. The patterns of the mosaic work are principally flowers and geometrical designs. Two of the rooms were supplied with hypocausts. As far back as the year 1828 an ancient Roman coffin was found in the same field, which has now yielded the vestiges of this villa to the activity of human progress. Roman remains of various kinds, especially coins, are not uncommon in the district, as at Cadbury for example. Other Roman villas are known to exist in the vicinity, and clear indications of ancient mining are afforded by the finding of pigs of lead with Roman inscriptions on them. Evidence also is not wanting that tends to prove that reclamation of the low-lying lands of the River Severn was practised in Roman times, even at a time before the villa was erected, for an inscribed stone indicating the amount of work performed by a Roman cohort stationed there was washed out of the embankment. No less than twenty-one Roman coins were discovered in the villa. These range from the time of Gallienus, A.D. 260, to Constantine I. A.D. 337, or II., A.D. 340, and thus denote an occupation of about a century. Mr. Pigott, who has superintended the excavations, has also been so fortunate as to find a hoard of about 800 coins about two miles away from this spot, at Kingston-Seymour; these are for the most part of the third century of the Christian era. The great care taken by Mr. Pigott in preserving the remains of the Yatton villa, and his intelligence in classifying the antiquities found on the site, deserve the highest praise, which we are sure will be universally accorded to him. It is a curious fact that so large a number of the deposits of coins found in Britain are of this above-mentioned date, and it was the opinion of Dr. J. Evans, President of the Society, that this points to some great crisis in the history of the past of the Roman Empire, probably during the reign of Tetricus, one of the thirty tyrants, and the last of the pretenders who ruled Gaul during its separation from the Empire under Gallienus and his successors, A.D. 267–274. Another curious fact, not fully explained, is the frequent finding in these hoards of spurious or imitation coins side by side with genuine coins of the same ruler: hence the former can hardly be called forgeries, as they can scarcely have been made use of for fraudulent purposes.

The Institute of Builders.—Mr. Richard S. Henshaw has been appointed Secretary of the Institute of Builders, on the resignation of Mr. Leonard J. Maton, B.A.

THE DESTROYED NORMAN TURRET AT ST ALBAN'S ABBEY.

Sir,—I have thought that the facts with reference to the Norman turret recently destroyed should be put on record by means of illustrations. Fig. 1 is a copy from the original drawing, which was reproduced by photo-lithography as plate 4 in my large book. The measurements of this were taken in 1876. This turret at the south-west corner of the south transept was part of the Norman building erected by Paul of Caen, and consecrated in 1115. It was constructed of Roman tiles up to the level of the string above the window arches, and was of considerable size, being 9 ft. 8 in. in diameter, and about 24 ft. high above the springing (of the Norman gable), which still remains. All above the highest part of this springer has been removed. The dimensions of the still existing turret on the north transept are almost identical with those of this turret, the destruction of which has created so much comment. The position and sizes of the openings, the character of the caps and bases of the shafts, and the arrangement of the arches, were similar to those in the north transept turret, and similar also to work in the great Norman tower (Fig. 5). The wall tiles were laid with wide joints, as elsewhere in the Norman work, and the newel of the staircase was of shaped Roman tiles, like the other newels of the Norman staircases.

Fig. 3 shows a detail of the shaft, cap, and base, from the turret.

Fig. 5 shows a part of the external gallery of the great Norman tower mentioned above, which may be compared with the arcade of the destroyed turret (Fig. 4).

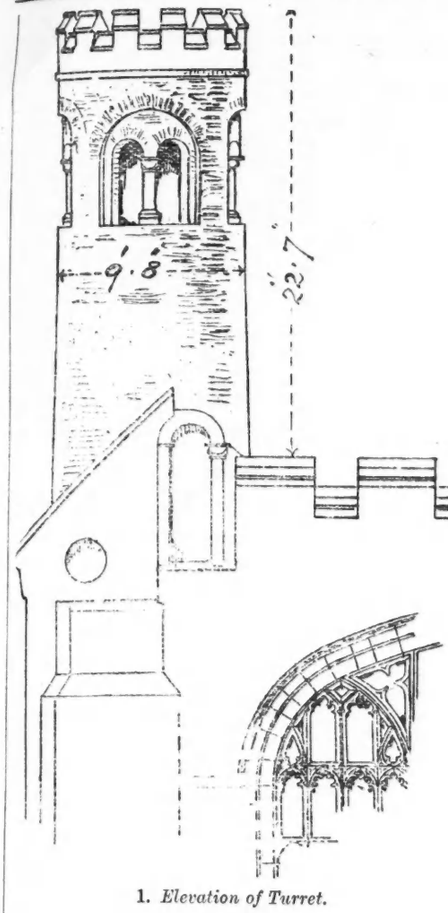
It has been suggested, on the part of the gentleman who is responsible for the destruction of the turret, that it was neither "in visible form or external structure" of Norman date, and that it was in very bad condition. I do not think there is any doubt as to its antiquity amongst those who know St. Alban's, and these illustrations will convince those who never saw it. As to the structural condition, I would mention that the turret was examined by the late Sir Gilbert Scott about ten years ago, and repairs were carried out under his direction. The parapets and the brickwork above the string over the openings, were of modern date. This work was not valuable, but was pleasant in colour and harmonised by time and weather with its surroundings. The old part of the turret below the string, over the openings, was very valuable, and the greater part of the 24 ft. in height was forcibly torn down with the aid of crowbars.

The mischief is done, and the *Builder* has said all that need be said. It has been stated that there is an intention to deal similarly with the north transept turret, and that some other portions of the buildings as well, now lead a threatened life, but I hope they will be spared.

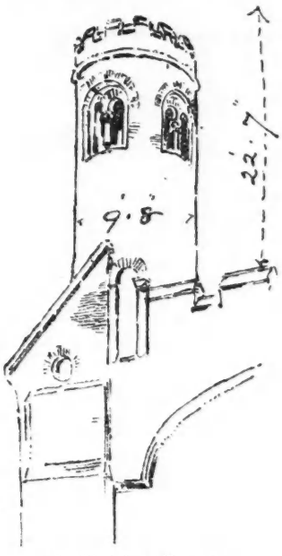
James Neale, F.S.A.

No. 10, *Bloomsbury-square, W.C.*

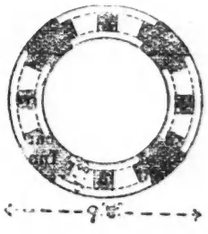
The Smithfield Club Show.—There was a good display of machinery and implements at the Agricultural Hall this week, but for the most part these pertained chiefly to agriculture. There were some exhibits of more general interest, however. Portable, "semi-fixed," and fixed engines of various useful types suited for builders' and contractors' purposes were shown by Messrs. Barrows & Stuart, of Banbury; Messrs. Clayton & Shuttleworth, of Lincoln; Messrs. Eddington & Stevenson, of Queen Victoria-street; Mr. E. S. Hindley, of Bourton; Messrs. Marshall, Sons, & Co., of Gainsborough; and Messrs. E. R. & F. Turner, of Ipswich. Wrought-iron tanks were shown by Mr. John Bellamy, and by Messrs. Burney & Co.; apparatus for well-sinking by Messrs. Isler & Co.; and fittings for stables, cow-houses, and piggeries by the St. Pancras Ironworks Company. The Ensilage Society exhibited a remarkably good show of ensilage, which seems to be rapidly increasing in favour, and in connexion with this subject Messrs. F. W. Reynolds & Co., of Southwark, showed their apparatus for compressing the silage. In the Arcade opening on to Islington-green, Messrs. Chambers, Monnery, & Co., of Bishopsgate-street, had a stand, their principal exhibits being two new stoves,—the "Fawcett" range, and a new patent "smoke-consuming" portable cooking range, for use with open or close fire,—which appear to embody several desirable improvements.



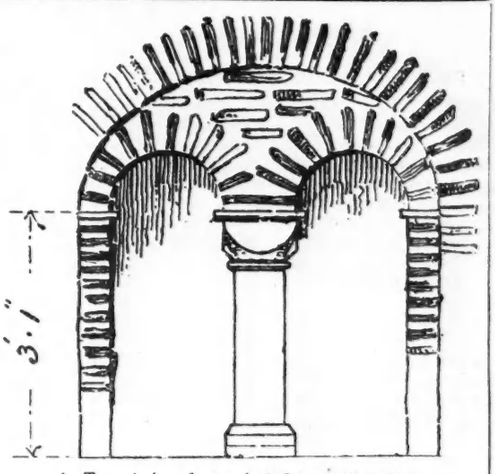
1. *Elevation of Turret.*



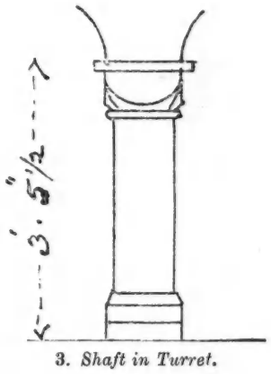
2. *Sketch of Turret.*



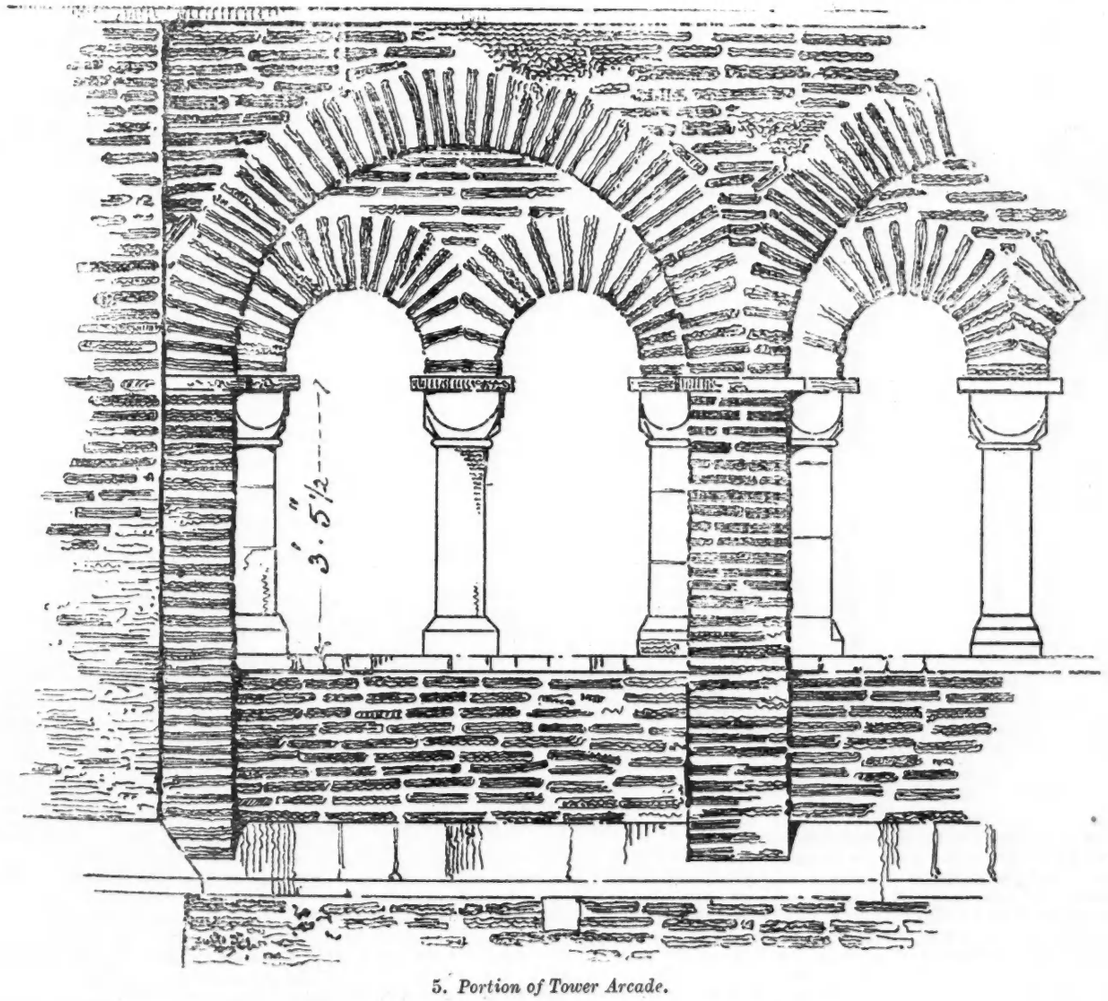
PLAN OF SOUTH TRANSEPT TURRET



4. *Turret Arcade, projected on a Flat Plane.*



3. *Shaft in Turret.*



5. *Portion of Tower Arcade.*

THE DESTROYED NORMAN TURRET AT ST. ALBAN'S.

Illustrations.

SKETCH OF LUCCA CATHEDRAL.

THIS is a reproduction from one of Mr. Ernest George's numerous and admirable architectural sketches, remarkable for the harmony of composition into which the square masses of the basilica and the adjoining houses fall. As an architectural illustration it is but slightly touched in regard to detail; it is as a piece of expressive architectural grouping that we reproduce it: a bit of the poetry of architecture.

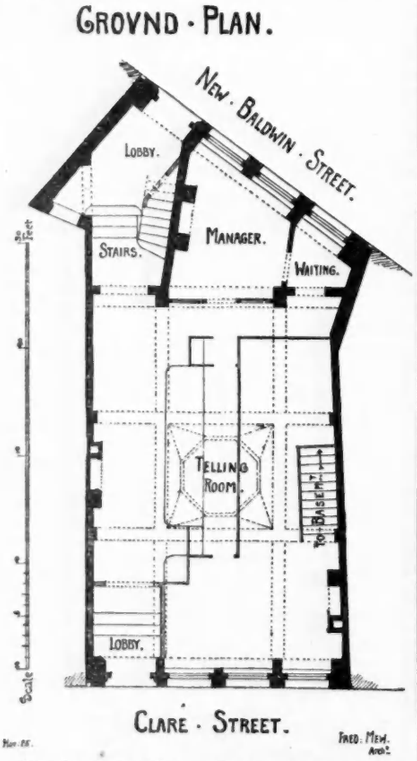
DESIGN FOR OFFICES.

THIS design, for offices or flats for a corner site, was hung in the Architectural Room at the last Royal Academy Exhibition. It is designed and drawn by Mr. P. J. Marvin.

NEW PREMISES FOR THE BRISTOL BRANCH OF THE CAPITAL AND COUNTIES BANK.

THE new premises for the Bristol Branch of the Capital and Counties Bank recently completed are situated on a site in Clare-street, with the advantage of an additional frontage to New Baldwin-street, giving access from both these important thoroughfares. The building consists of five stories, of which the ground and basement floors are devoted to the purposes of the bank, the upper floors having been arranged for suites of offices and caretaker's apartments. The ground-floor is entirely taken up by the telling-room (with a dome skylight in centre), except the portion towards New Baldwin-street, where the manager's rooms and the staircase are placed; and on the basement are the store and strong rooms, lavatories, kitchen, &c.

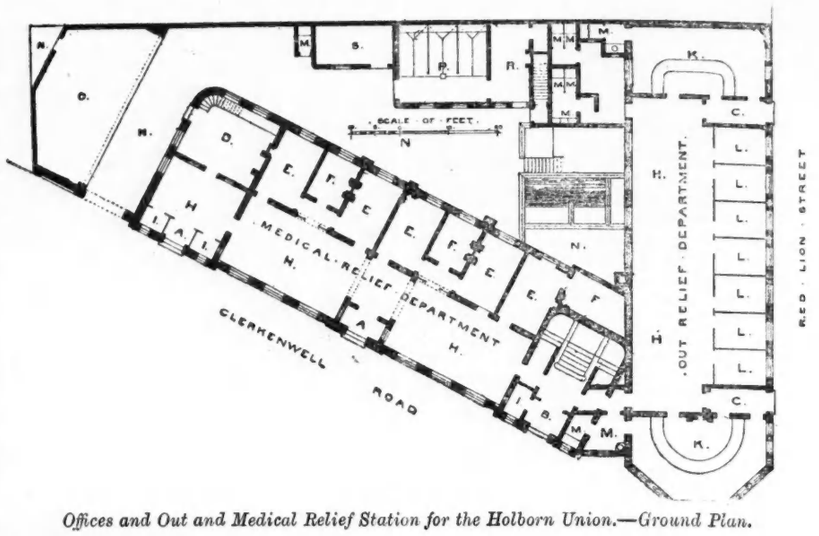
The two fronts being nearly equal in size are similar in their architectural treatment, which is carried out with details somewhat Greek in character, having rustication on the ground-story, and recessed upper stories, with three-quarter columns, and pilasters, cornices, and pediments.



The fronts as high as the top of ground-floor are executed in Belgian granite, similar to that used in the New Law Courts at Brussels, this building being the first in which it has been used to any extent in this country.

The columns to the upper stories are of polished grey marble, with carved capitals, the whole of the fronts otherwise, above the ground-floor cornice, being faced with Bath stone.

The works have been carried out by Messrs. W. Cowlin & Son, of Bristol, Mr. E. Honey having acted as clerk of works.



Offices and Out and Medical Relief Station for the Holborn Union.—Ground Plan.

A. Entrances to Medical Relief Department.
B. Entrance to Board Room and Offices on Upper Floor.
C. Entrances to Out Relief Department.
D. Dispensary.
E. Medical Officers' Consulting Rooms.
F. Medical Officers' Examination Rooms.
H. Waiting Rooms.
I. Porters' Rooms.
K. Committee Rooms.
L. Relieving Officers' Rooms.
M. Water-Closets and Lavatories or Urinals.
N. Yards.
O. Ambulance Shed.
P. Stables.
R. Harness Room.
S. Hay Store.

The fireproofing of the several strong-rooms, and the constructional ironwork havebeen supplied by Messrs. Dennett & Ingle, of Whitehall; the Belgian granite work and marble columns by Messrs. Tagnon, of Gray's Inn-road, from their quarries at Wellin, in Luxembourg. The stone of the fronts is from the Corsham Bath Stone Company's Quarry; the carving was executed by Mr. E. Sheppard, of Bristol.

The architect was Mr. Frederick Mew, of London.

THE MONUMENT TO THE LATE MR. J. R. GREEN.

THIS monument to the late Mr. Green, author of the well-known "History of the English People," is erected in the cemetery at Mentone. It is of the finest white statuary marble from Serravezza, delicately carved; the central panel is an "Investitura" of Giallo di Sienna, polished, and bearing the epitaph of bronze letters riveted through the backing. The lunette is also of Giallo di Sienna, having a circular panel of white marble, inclosing a laurel wreath in relief on a ground of gold mosaic. The flutings in the soffit of the arch are also filled with gold mosaic.

The work has been carried out by Signor Cappabianca, of Rome, from the drawings and details of Mr. Howard Ince, of London, from whose drawing our illustration is taken.

FREE PUBLIC LIBRARY, WIMBLEDON.

THE design shown in our illustration was selected in public competition in July last, about forty sets being submitted. The plan is very simple, the point striven at being that the Librarian or his Assistant should be able to thoroughly oversee the whole Library without much walking about. Then, as the newspapers, &c., have most readers, they are placed near the door, with the tables for those using reference library situated in the more retired parts of the building. The Librarian's rooms are over the front entrance, and have a private communication to both street and office. Tenders have been submitted, that of Mr. Johnson, of Wimbledon, being the lowest, 2,165*l.*, including lighting and heating, but not the bookcases. The architects are Messrs. Potts, Sulman, & Hennings, of London.

CHURCH OF NOTRE DAME, DINANT.

THE Church of Notre Dame, Dinant, was commenced at the end of the twelfth century. The triforium is specially worthy of notice. The slender columns supporting the arcading in the chancel seem scarcely strong enough to support the great weight imposed upon them, and are now tied together and strengthened with iron rods. The windows in the end wall are bad modern restorations.

The drawing by Mr. R. A. Biggs was exhibited at the Royal Academy.

HOLBORN UNION ADMINISTRATIVE OFFICES AND MEDICAL AND OUT RELIEF DEPARTMENTS.

THE foundation stone of this building was laid by the Guardians of the Poor of the Holborn Union on the 10th inst.

The building provides accommodation on the ground-floor for the Out Relief and Medical Relief Departments in the shape of large and well-ventilated waiting-rooms for the paupers, and commodious consultation-rooms for the use of the medical and relieving officers, besides two committee-rooms for inquiry by the Guardians into the *bona fides* of the applicants for relief.

In the rear of the site provision is made, in the shape of stabling and ambulance sheds, for the conveyance of the paupers to the various outlying infirmaries, schools, and other buildings of the union.*

The whole of the upper floors of the main building are devoted to the clerks' and other administrative offices, besides board and committee-rooms for the meetings of the Guardians. The nature of the ground required that a basement should be constructed over the whole site, and the space will form good accommodation for strong-rooms, drug stores, heating furnaces, &c.

The architects are Messrs. H. Saxon Snell & Son. The builder is Mr. Mark Gentry, who has undertaken to execute the whole of the works, including fittings and every accessory, for the sum of 16,490*l.*

Royal Institution of Great Britain.—At the general monthly meeting, held on Monday last, December 7th, 1885, Mr. George Busk, F.R.S., Treasurer and Vice-President, in the chair, the following were among the lecture arrangements announced:—

Reginald Stuart Poole, Esq., LL.D., of the British Museum, Corresp. Inst. France. Three Lectures on Naucratis: (1) Relations of the Greeks with Egypt from the Heroic Age to Psammitichas; (2) The Emporium of Naucratis; (3) The Egyptian Sources of Greek Art. On Tuesdays, Jan. 26, Feb. 2, 9.

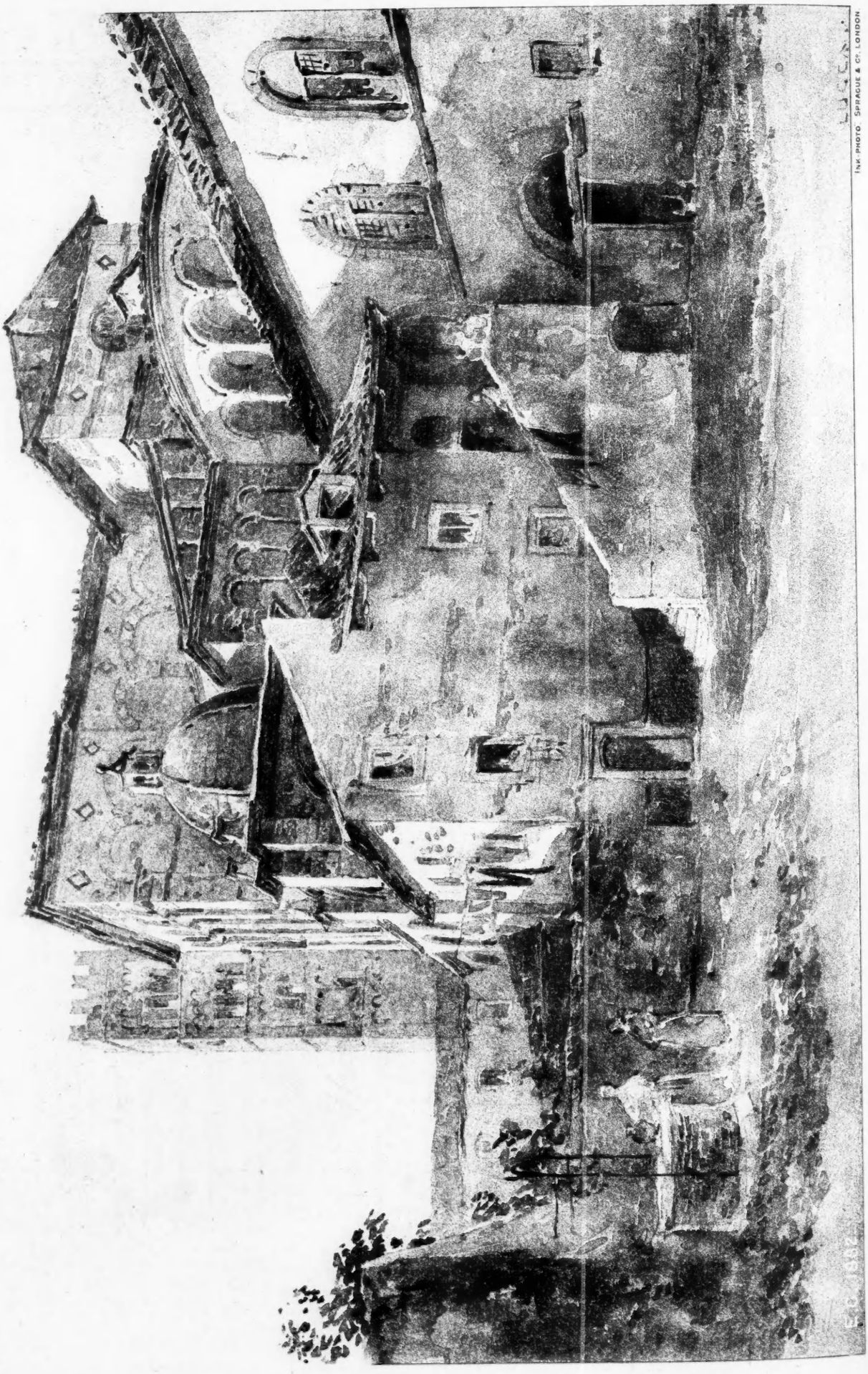
Charles T. Newton, C.B., LL.D., M.A. Three Lectures on the Unexhibited Portion of the Greek and Roman Sculptures in the British Museum (illustrated by Drawings and Casts). On Tuesdays, Feb. 16, 23, March 2.

Rev. C. Taylor, D.D., Master of St. John's College, Cambridge. Two Lectures on the History of Geometry: the Greeks and the Moderns. On Saturdays, Feb. 27, March 6.

Professor Oliver Lodge, D.Sc. Two Lectures on Fuel and Smoke. On Saturdays, April 10, 17.

Society of Medical Officers of Health.—At a meeting of this Society to be held on Friday next, December 18th, Dr. E. C. Seaton will read a paper on "The Recommendations of the Royal Commission on the Housing of the Working Classes as they affect the Status of the Medical Officer of Health."

* The plan, as will be seen, is on the lithographed view, but so small that we have thought it better to give a larger one separately.



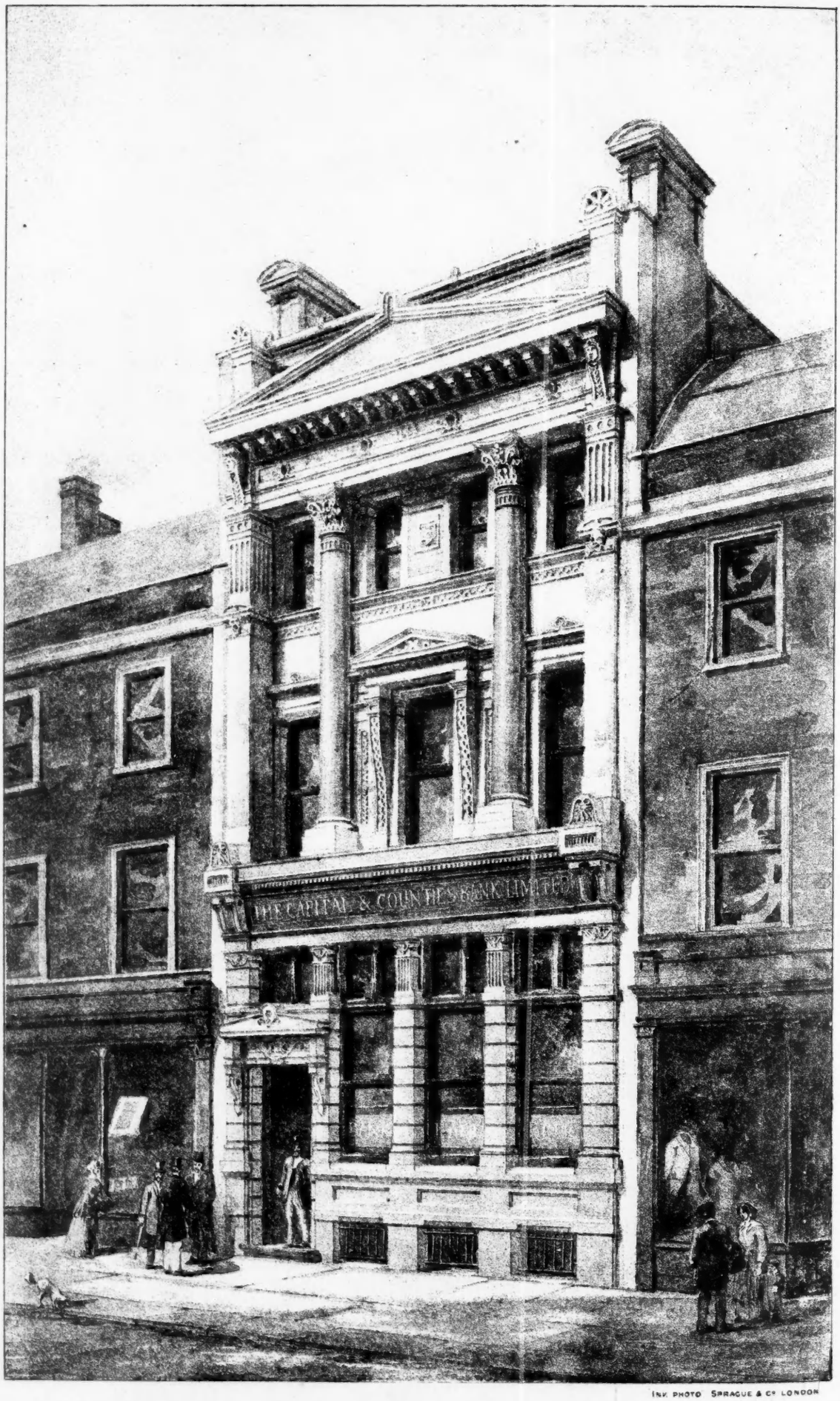
LUCCA CATHEDRAL.—From a Water-Color Drawing by Mr. Ernest George.

INK PHOTO. SPRAGUE & CO. LONDON.

"INK-PHOTO." SPRAGUE & Co. LONDON.

DESIGN FOR A BLOCK OF OFFICES FOR A CORNER SITE.—By Mr. P. J. Marvin.

(EXHIBITED AT THE ROYAL ACADEMY, 1885)



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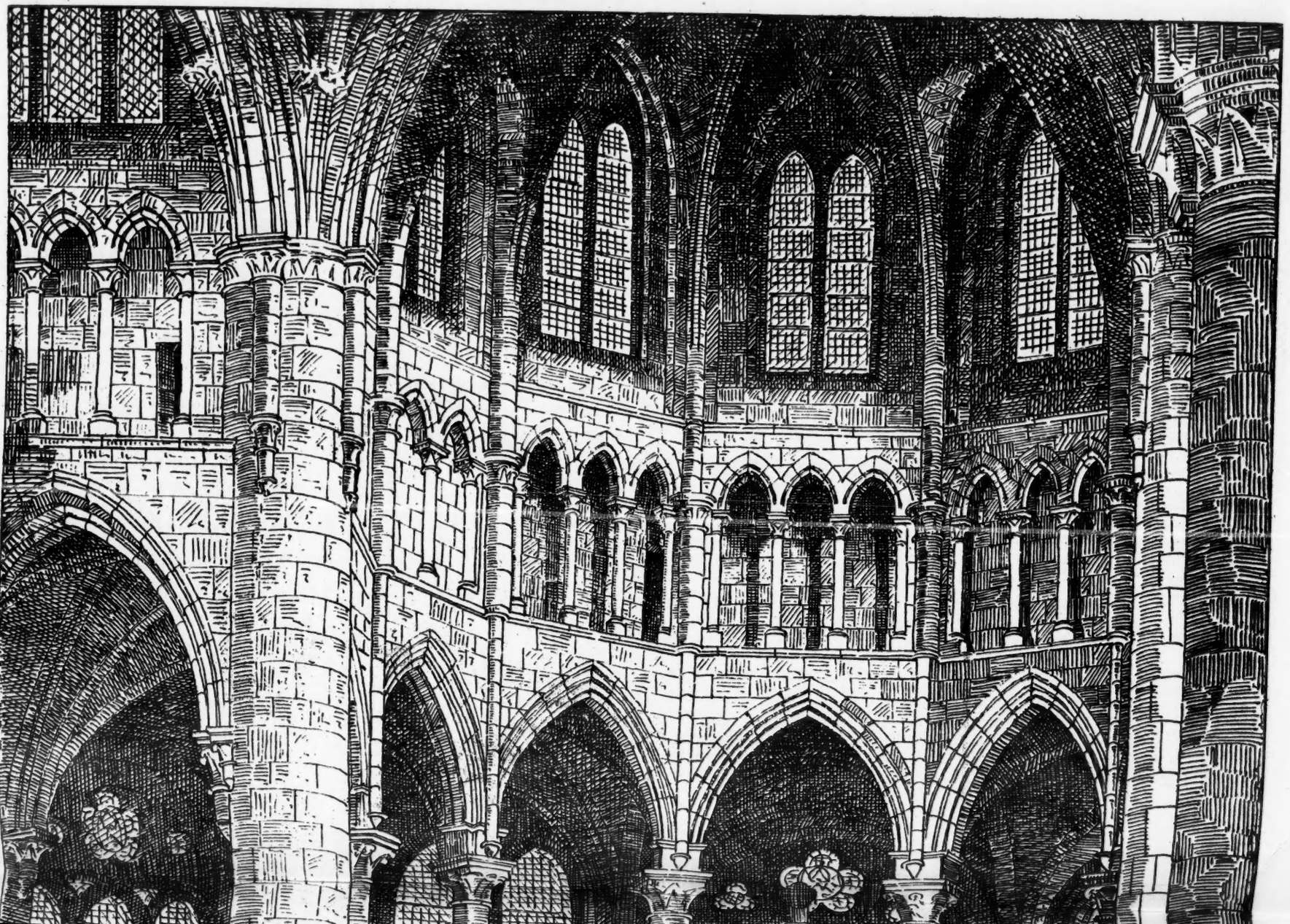
NEW PREMISES FOR THE BRISTOL BRANCH OF THE CAPITAL AND COUNTIES BANK.

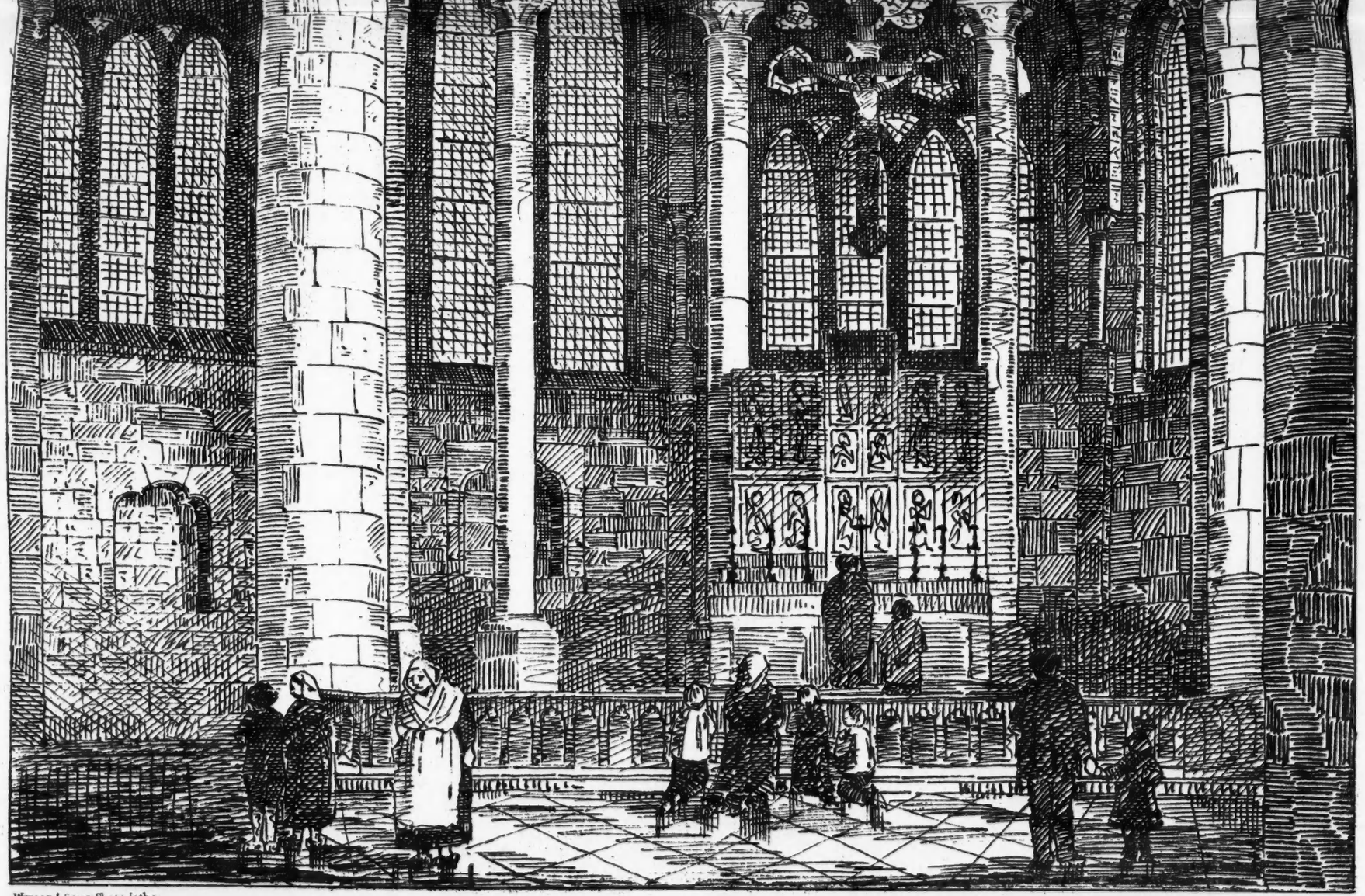
MR. F. MEW, A.R.I.B.A., ARCHITECT.

INK PHOTO SPRAGUE & Co. LONDON.

MEMORIAL TO THE LATE J. R. GREEN, IN THE CAMPO SANTO, MENTONE.

Mr. Howard Ince, Architect





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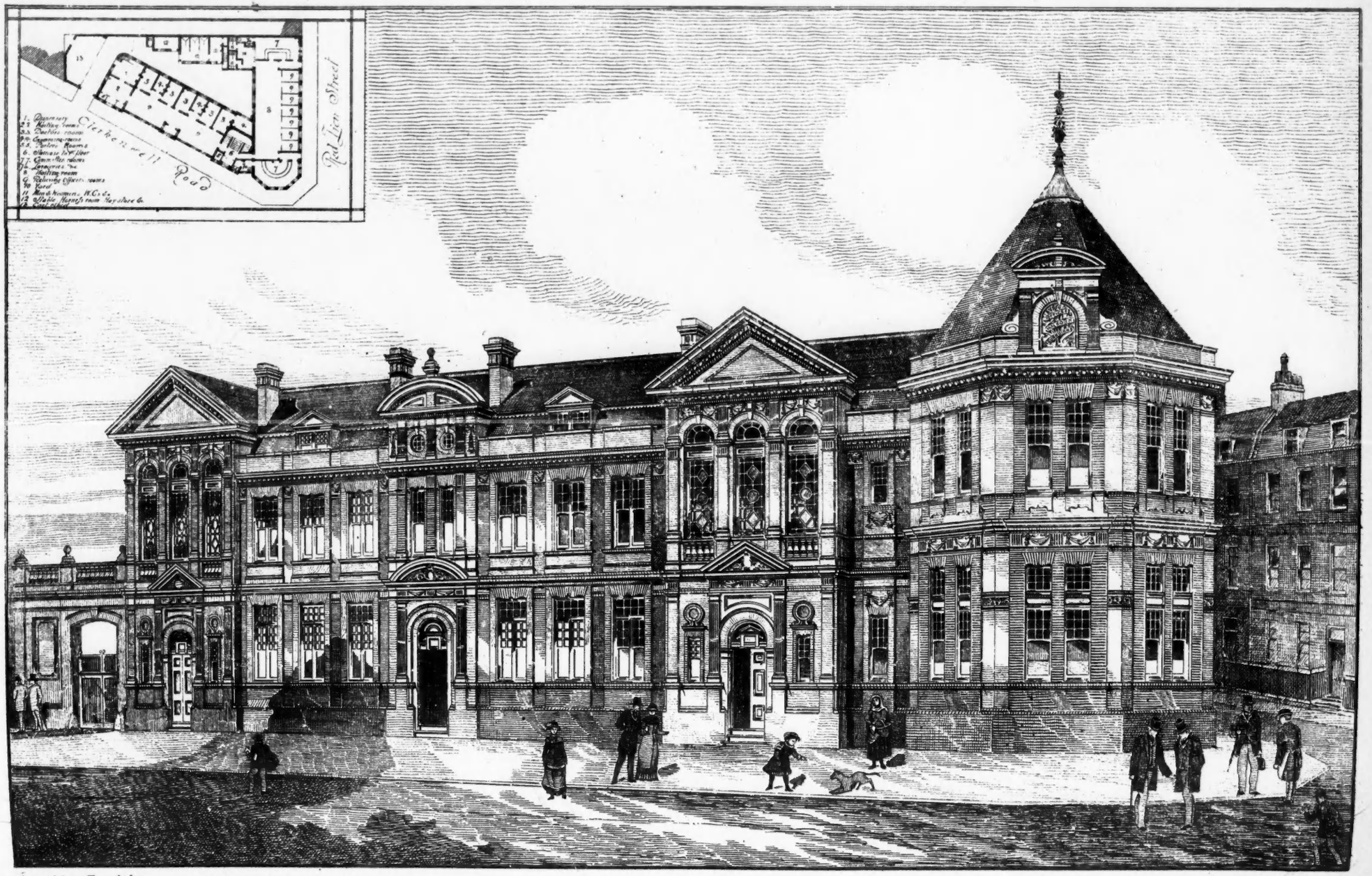
6 Queen St London W.C.

INTERIOR OF THE CHURCH OF NOTRE DAME, DINANT.—Drawn by Mr. R. A. Briggs, A.R.I.B.A.

(*Exhibited at the Royal Academy*, 1885.)



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HOLBORN UNION, DISPENSARY, RELIEF STATION, AND GUARDIANS' OFFICES.——Messrs. H. Saxon Snell & Son, Architects.

C^t Queen St London, W.C

THE BUILDER, DECEMBER 12, 1885.

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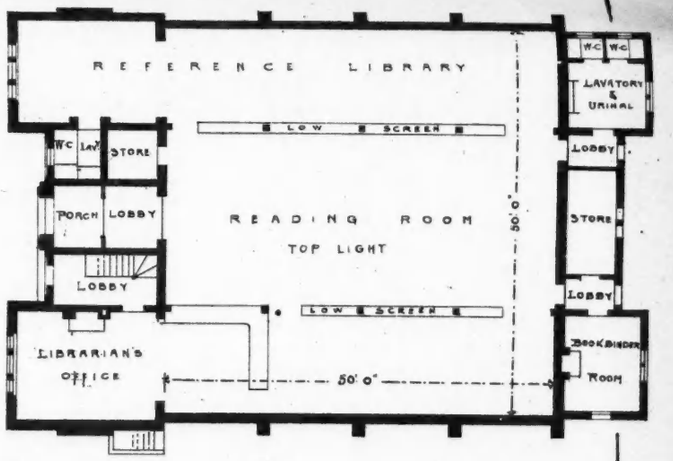
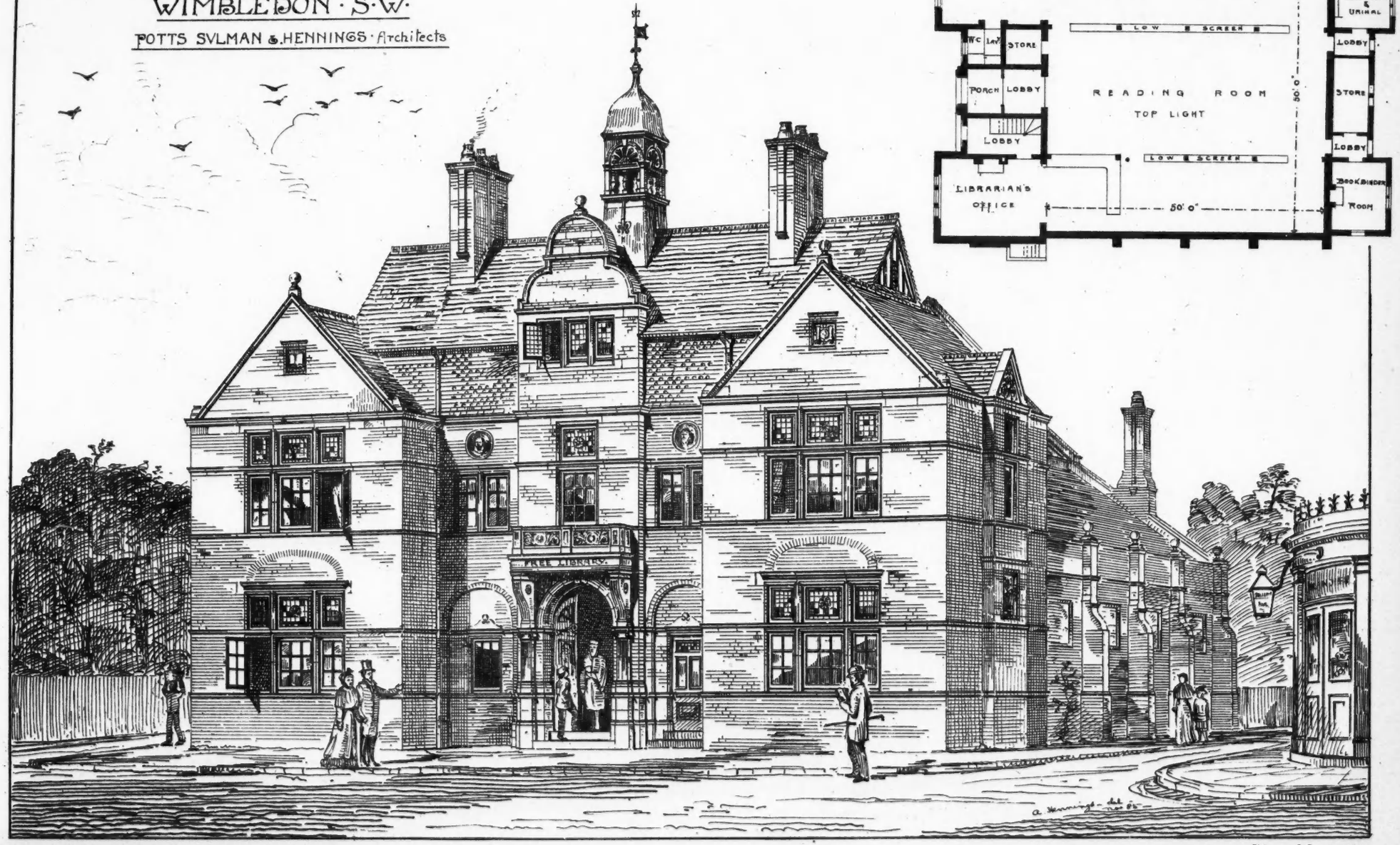
POTTS SULMAN & HENNINGS · Architects





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THE VENTILATION OF PRIVATE DWELLINGS.

ARCHITECTURAL ASSOCIATION.

THE fourth meeting of this Association for the present session was held on the 4th inst., at Conduit-street, Mr. J. A. Gotch (Vice-president) in the chair.

It was announced that Mr. William H. White (Secretary of the Institute) had offered the members several copies of his paper on "Architecture: its Past, Present, and Future," read by him before the Leeds and Yorkshire Architectural Society.

With respect to the water-colour class, now being formed, it was stated that those desirous of joining should communicate with Mr. Hilton Nash before the 31st of March next.

Mr. G. H. Blagrove then read a paper entitled "Ventilation of Private Dwellings." He said:—

The atmosphere, as most persons are aware, is mainly composed of two gases, nitrogen and oxygen. The former, constituting nearly four-fifths of the entire body of the air, serves as a medium in which the other ingredients are diluted. Of the oxygen there is rather less than 21 per cent., and its presence is essential to the support of animal life. The percentage of it which we consume in breathing varies according to circumstances, such as age, sex, time of day or night, whether we are sleeping or waking, and whether or not we have just partaken of a meal. The smallest amount is probably 4 per cent., while the largest has been stated at more than 12 per cent. This appears to be an exaggeration, because, according to a certain law of affinity between gases, we cannot abstract much more than 10 per cent. of oxygen from the atmosphere, however often we inhale it. I do not think it safe to allow less than 10 per cent. for our average consumption, because we must remember that at night a certain proportion of oxygen is abstracted from the air by vegetation. We see from this the danger of attempting to breathe the same air twice over. Besides other gases of various kinds in minute quantities, common air contains carbonic acid gas, or anhydride of carbon, to the amount of about four parts in 10,000. In exchange for the pure oxygen which we inhale, we return to the air nearly 8 per cent. of carbonic acid, and a variable amount of watery vapour impregnated with certain organic impurities. This vapour does not mix uniformly with the air, but has a tendency to hang about in clouds, similar to those which become visible in a partial vacuum. I calculate that, altogether, we evolve about 11 cubic feet of vitiated air per head every hour, including what is thrown off by the skin. Carbonic acid gas has been spoken of as poisonous, but this appears to be a mistake. It has the power, when in sufficient quantity, of producing suffocation; but the most poisonous ingredient in exhaled air is said to be the organic impurities discharged. It will be seen that we require 11 cubic feet of pure air per head every hour for breathing purposes; and, if we could depend upon its purity, this amount would suffice. It must not be imagined, however, that if we introduce this amount into a room, it will be sufficient, because the impure air which we throw off has a tendency to diffuse itself, thus polluting a large proportion of the air which we require for breathing purposes. In a room containing a given number of persons, a certain amount of polluted air must be withdrawn per hour, and, of course, an equal amount of pure air must be introduced to replace it. This amount has been variously stated by different authorities. Some early writers on ventilation have given it at from 2 to 4 cubic feet per minute, or from 120 to 240 per hour. Péclet states it at 250, Hood and Morin at 300, Dr. Reid at 600, and Capt. Douglas Galton arrives by experiment at 1,200, and by calculation at 3,000. This calculation is based upon the assumption that the impure air diffuses itself rapidly at a uniform rate throughout the entire atmosphere of a room. The assumption is nearly true as regards the carbonic acid, but not as regards the organic impurities. Adopting this assumption, however, we find that although a large volume of air requires a longer time to reach a given standard of impurity than a smaller one, yet when that standard is reached, the supply of fresh air necessary to prevent higher contamination is the same in a small as in a large room. We should then have to make up our minds as to what degree of partial purity would satisfy us, and regulate the ventilation accordingly. Ventilation would then consist, as it often does, in merely diluting impurities which can never be completely expelled. There is no doubt that the organic impurities thrown off by the skin and lungs are apt to linger in the corners of a room, and can only be driven away by strong currents of fresh air introduced by opening windows and doors for a certain period every day. This is the "airing" to which every inhabited room should be subjected, and is quite distinct from regular ventilation.

The hypothesis that exhaled air diffuses itself uniformly cannot be sustained, because it has a tendency to ascend, through being lighter than the air at ordinary temperatures. It is lighter because it is rarified by heat, and saturated with vapour. I find that a cubic foot of exhaled air weighs just 493 grains immediately after it is expelled from the lungs. It is soon partially chilled, however, and arrives at the same specific gravity as that of common air at about 80° Fahr., in which temperature it has no tendency to rise, but hangs about in clouds, and is liable to be inhaled over again. This is one reason why heated rooms are unhealthy, another being that as the whole atmosphere is rarified, the same quantity of oxygen cannot be inhaled at a breath as in colder temperatures. Most persons will find 65° a pleasant as well as healthy temperature, and I should never recommend anything higher than 75°, except in Turkish baths.

If we suppose the fresh air to be introduced from the lower part of a room, while the foul air finds an exit at the ceiling level, we shall see that it might be possible to keep the supply practically pure. To my mind, the problem of perfect ventilation depends upon two conditions: the rate at which the foul air ascends, and the rate at which it is diffused. If the velocity of diffusion were equal to the velocity of ascent, the air below the level of our nostrils would never be contaminated by our breath, which would be constantly replaced by perfectly pure air. All we should have to do then would be to provide for the egress of as much air as could become contaminated in the time occupied by each exhalation in reaching the outlet. The higher the outlet the greater would have to be the amount of outflow, and by consequence, the greater the amount of supply. The velocity of ascent would be retarded as the foul air approached, by admixture, an equal density with the surrounding air; it would, in fact, vary directly as the square root of the difference of density. The velocity of diffusion would vary inversely as the square root of its density, but would be nearly uniform. From calculations too long to be quoted here, I arrive at the conclusion that when an outlet is not more than 12 ft. from the floor the foul air will reach it in about ten seconds, during which time it will have been diffused in about forty-three times its volume.

This gives the amount of outflow at about 473 cubic feet per hour for each individual,—let us say an average 500 ft.,—and this should be the allowance in ordinary dwellings. In the case of artificial lights, separate outlet tubes should be provided for gas brackets or pendants, or for any kind of light which is fixed. The products of combustion from candles which are carried about are too trifling to merit consideration; but it may be useful to remember that two candles are said to consume as much oxygen as one grown person.

As regards the capacity of outlet tubes, that must, of course, depend upon the velocity of the outflow, which is governed by the difference of temperature between the foul air and the surrounding atmosphere, and, in fact, varies directly as the square root of that difference. It is greater according to the length of the extraction-flue, provided that the foul air is not chilled in its passage. With an average difference of 3 deg. in a tube or flue 10 ft. long, the velocity will be about 5,000 ft. per hour; or an outlet of 1 ft. superficial capacity will extract sufficient for ten persons. An outlet 4½ in. by 3 in., or of about 14 square inches capacity, would, under these circumstances, suffice for one person; and this is the allowance which should be made. Of course, if we have any artificial means of extraction, much less will do; but such means are generally too expensive to be adopted in private dwellings. Natural ventilation,—that in which we depend for our extracting power upon the difference between the specific gravities of warm and cold air,—is that on which we must chiefly rely. It is well to remember that foul air is heavier than pure air when both are at the same temperature, as we shall thus understand the danger of allowing the former to become chilled.

Probably a bedroom is the most difficult apartment to ventilate satisfactorily during the night. In an average room let us consider what happens. The air of the room is warmer than that outside, and consequently it ascends the chimney in a central column, while there is a certain amount of down-draught,—usually very little,—in the sides and angles of the flue. The air abstracted from the room is chiefly supplied through the crevices of the door, and as it comes from the interior of the house it is therefore very far from being pure. Unless the staircase windows are kept open, the house will be largely supplied with air from the lower part, that is, through the crevices of external doors. Such air will be impregnated with impurities, some of which will be drawn from the sewer gratings in the roads, through which authorities persist in allowing our streets to be poisoned. This air, such as it is, is chiefly available for ventilating our bedrooms, and it partially purifies the air up to the level of the fireplace opening, scarcely disturbing the air above it. Woe betide the sleeper if his bed be above this level, for he will pass the night in a stratum of air which will continually grow more and more impure. Architects generally keep down the height of a fireplace opening to within a reasonable proportion of its width, and, as bedroom fireplaces are never very wide, we have in most houses some wretched little pigeon-holes to do duty as ventilators. If the sleeper's condition be generally bad in a room containing a fireplace, what must it be in a room which has none? We may safely assume that if it were not for cracks and crevices in imperfectly constructed windows and doors, many persons would be suffocated, and this is one argument in favour of "jerry" building.

There should be outlets in or near the ceiling. If you put your outlet at any level below the ceiling, you will have a constant stratum of foul air down to that level, and it will be liable to pollute the remaining air of the room. There may be any number of outlets, which may take the form of ornamental perforations, but they should all communicate by outlet tubes with one flue carried up the wall. If you have two or more extraction-flues to the same room there is always the danger of a down-draught being established in one of them, through differences of atmospheric pressure. In order to maintain a constant up-current in an extraction-flue, the flue must be carried down below the level where the foul air enters it, to some point where cold air can be admitted. This can easily be done in external walls by means of gratings. In internal walls, the flues may be carried down to a cellar in the basement, into which air can be admitted through tubes or gratings. We should then consider that a column of air, equal in height to the entire atmosphere, is pressing upon the opening at the lower end of the flue, while a column of the same height, minus the height of the foul air in the flue, is pressing upon the top, the result being an up-current. I have known extraction-flues closed at the top and provided with side gratings only. This I conceive to be a mistake, as the air blowing in through this grating may acquire a downward direction, checking the up-flow of foul air. There should always be a vertical opening, for there is no apparent reason why foul air should behave differently to smoke, and its upward passage may be assisted by means of louvred gratings let into the sides of a stack. Boyle's or other extractors are undoubtedly useful. Their operation depends upon the principle that a current of air blowing across an opening causes a partial vacuum which creates an up-current, as exemplified in the well-known apparatus for diffusing scent by means of two glass tubes; but of course no dependence can be placed upon these extractors in calm weather.

There is always a danger of foul air being retarded in its passage to an extraction-flue by the pressure of cold air already there. The difficulty has sometimes been obviated by conveying all the outlet tubes into one large foul-air chamber, say, in the roof. Thence the foul air is carried into the extraction-flue, and it is found that a steady outflow is better maintained through a tube, when it is backed up, so to speak, by the pressure of this large body of foul air behind it.

There are artificial aids to extraction which may be invoked in ordinary dwellings, the most

first floor communicating with the chapel by means of an open corridor. The dormitories are arranged with dwarf divisions down the centre, the beds being placed head to head, as well as along the walls. The aged wards have the bath-rooms on the same level, the able-bodied baths being on the ground-floor. The dormitories are so arranged that each ward is supervised by an officer's bed-room with a fixed light.

The latrines are placed in towers connected with passages, with cross ventilation, the horizontal soil-pipes being of lead inside the building, the down-pipes being of iron, trapped at the connexion with the drain, and carried up to the top of the tower, and finish with a ventilator, which acts as an exhaust and inlet; the other ends of the soil-pipes are also carried up to the top of the tower, and have exhaust cowls, the bottom of the pipes being left open: by this means it is impossible to syphon out the water in the traps of the closets. The ventilation of the drain-pipes is arranged in the manholes the drains all being laid in straight lines.

The principle adopted for the ventilation of the wards consists of tube-inlets fixed about 7 ft. from the floor, the outlets being arranged in four brick flues to each ward, which are finished at the top with Boyle's ventilators, the current being assisted by means of a conical gas-burner fixed in the flues.

The gas-pendants are also provided with ventilating-tubes carried into the flues, the tubes being laid with a slight incline towards the flue, to assist the current as the fumes cool.

The heating is done by hot-water pipes, the water being heated by steam from the boilers; there are in addition open fireplaces for the sake of cheerfulness.

The buildings are designed for 1,200 paupers, and the administrative block has been carried out completely; the wards at present built are intended for 620 only, the additional accommodation being left to be provided, if required, by extending the pavilions northwards.

The children are provided for in buildings which are kept quite apart from the adult inmates, and, as they are sent away to Anerley to school, no provision for school-rooms has been made.

The casual wards are not yet built, but they will be placed away from the workhouse.

Mr. Aldwinckle kindly met the members of the Association and conducted them over the buildings, giving a very full and interesting description of the various arrangements; and great interest was exhibited in the various fittings, which have all been specially designed for the building, and which appear to be admirably suited for their various purposes.

BRITISH ARCHÆOLOGICAL ASSOCIATION.

The second meeting of the new session was held on Wednesday, December 2nd, Mr. Thomas Morgan, F.S.A., in the chair.

Mr. Cecil Brent, F.S.A., exhibited several curious Roman vases of Upchurch ware and Samian ware, found in excavating for a new gasometer near Canterbury Castle.

Sir Henry Dryden reported the discovery of a sepulchral slab in Moulton Church, Northants, with a curious but not unfrequent pattern of Mediæval times, which has not yet been explained.

In the discussion which followed, one of the speakers considered that the pattern was intended for two bows of double curvature, a rectangular bar with barbed heads being intended for an arrow.

Mr. J. T. Irvine exhibited a large number of curious stones and crosses, mostly in Northants, of Saxon date. He described also a portion of a Roman column covered with leaf-pattern, which has been found built up as old material on taking down the central tower of Peterborough Cathedral. A Saxon funeral slab has also been found there in its original position on what was once the cemetery of a small early church, but afterwards enclosed by the larger building.

Mr. Loftus Brock, F.S.A., described a hand-made sepulchral urn, of Saxon date, found at Brixworth, in one of the several cemeteries that have been met with in recent years during the excavations for ironstone, and which point to the existence of a large population here in early times.

Mr. Edenborough exhibited a curious piece of pottery representing a Norman horseman and horse, recently found in Old Broad-street, unlike several other figures of this class; the present example had not been a drinking-vessel.

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CIRCULAR HOSPITAL WARDS.

Sir,—It has been my misfortune to be deluded into discussing the above subject with Mr. Burdett in the columns of three of your contemporaries, and in consequence of the persistent manner in which this gentleman continued week after week to base his arguments upon false statements and pretended extracts from my writings (which extracts were in reality simply the emanations of his own fertile brain), I have refused to continue the correspondence. He now makes his appearance in your journal, and, as I imagine, you would be sorry that your readers should be misled by the tabulated statement you published last week upon the faith of Mr. Burdett's name, I will forward for your inspection the following documents:—

First.—A letter from Dr. Mouat enclosing documents obtained from a high official source in Belgium, stating that the accommodation for patients provided at the Antwerp Hospital is 382 beds, viz.:—

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Secondly.—Photographs of the working drawings of the building, signed by the architects, whereon are delineated the positions of every bed in the various rooms, and corresponding with the above statement as to the number of beds in each ward.†

Thirdly.—The printed reports of the "Conseil Supérieur d'Hygiène Publique," the body whose consent it was necessary to obtain before the building was allowed to be erected.

You will observe that in the first of these reports the Council refused to sanction so many as twenty-four beds being placed in the circular wards, and that the design was referred back to the Communal Administration at Antwerp for revision in this respect. Then that in the second and last report they say, in agreeing to the revised plans,—"The circular wards of the new project will certainly not have some of the inconveniences we have mentioned. Each of the rooms will not accommodate more than twenty sick in place of the exaggerated twenty-four, and each of the twenty beds will be found placed in front of a pier. In this manner the beds would be more distant and access will be rendered easy and commodious."

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Practically, then, all these statements are in accord. The architects who erected the building say, both by written documents and by their drawings, that the design for the building was made to accommodate, in round numbers, 380 patients, and the circular wards twenty beds each.

The Conseil Supérieur d'Hygiène refuse to allow more than twenty beds to be placed in a ward or more than 380 beds in the whole establishment, and I have stated in my work that the authorities having charge of the erection of the building at the time of our visit assured Dr. Mouat and myself that these were the numbers it was intended that the building should accommodate.

Yet Mr. Burdett in the face of this first asserts that the architect told him the building was erected to accommodate 400 patients, and now he produces the document published by you last week, which purports to show that it holds 468 beds.

Of course it is possible that this document is a true statement of the existence of gross overcrowding in the wards of the establishment, but what bearing can this have upon the question at issue?

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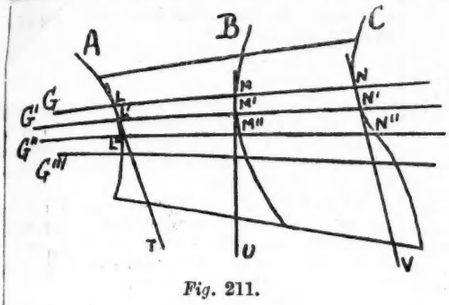


Fig. 211.

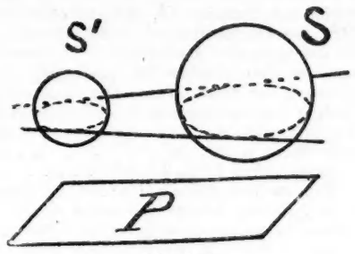
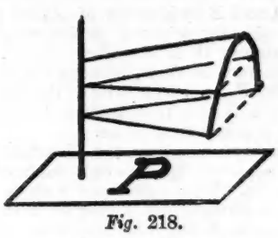


Fig. 214.



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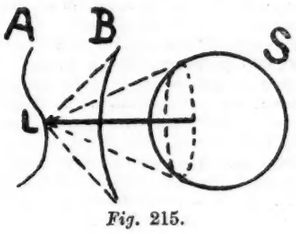
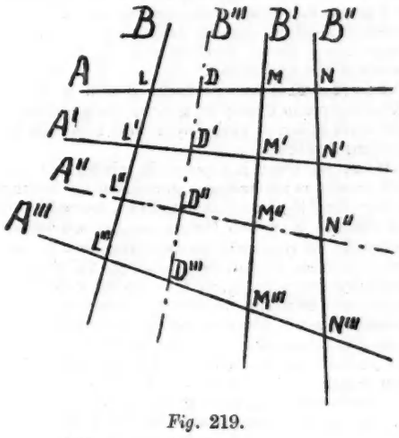


Fig. 215.



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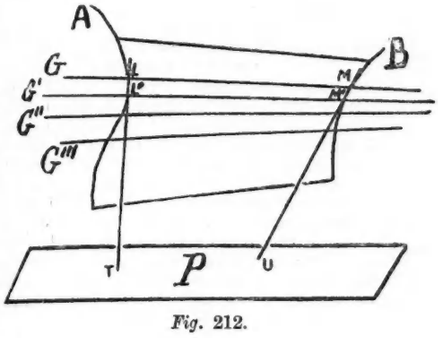
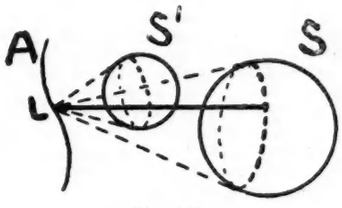


Fig. 212.



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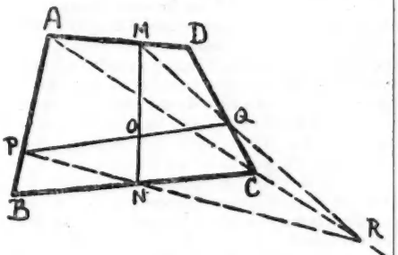

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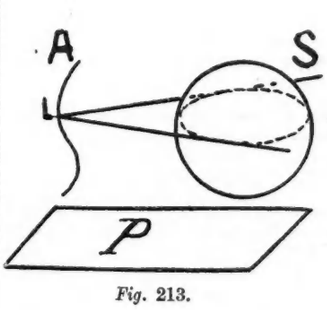

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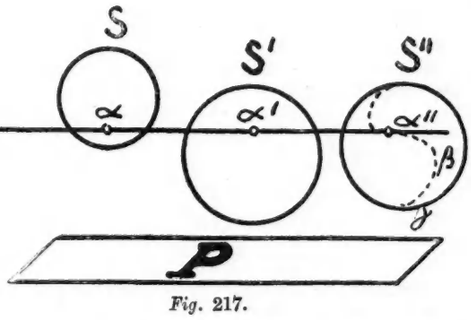

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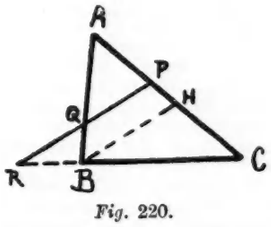

Fig. 220.

The Student's Column.

DESCRIPTIVE GEOMETRY.—PART II.

XXVIII.

SKEW SURFACES.

ALL surfaces engendered by the motion of a straight line are *ruled surfaces*. These surfaces are divided into two categories,—the one *developable surfaces*, which we have studied; the other *skew surfaces*, which often occur in masonry, and require our readers' most earnest attention.

Skew surfaces are described by the motion of a straight line, but *two consecutive generators*, however close, *are not contained in the same plane*. This is the essential feature which differentiates skew from developable surfaces.

Before showing how we can produce surfaces the generators of which realise the above condition, we beg to observe that, as a result of that condition, the elementary portion of such a surface comprised between two neighbouring generators *is not a plane*, but *a skew surface*. For (see fig. 211), in all the curves A, B, C . . . . you may delineate on the skew surface, the linear elements L L^1, M M^1, N N^1, which are straight lines, having each one point on G the other on G^1, cannot be in one plane if the generators G and G^1 are not themselves in one plane. Besides this, as the tangents L L^1 T, M M^1 U, N N^1 V . . . . prolongations of the linear elements of the curves are not in one plane, it is evident that the tangent planes G L T, G M U, G N V . . . . *which are tangent to the skew surface in the points* L M N . . . . *of the same generator*, are distinct different planes, although they all contain the generator G.

From the above we conclude also that with skew surfaces every plane, such as G L T, although really tangent to the surface in the point L (this means, containing the tangents to all the curves drawn on the surface through this point), yet cuts the surface in every other point which the plane and the skew surface may have in common. It cuts the surface first along the generator G itself, and secondly along another line which passes through the point L, a line which may be straight or curved according to the shape of the skew surface given.

We shall now show how Skew Surfaces can be produced.

The motion of a straight line is not determined by the line being bound to touch one or even two directing curves; for (see fig. 211) from any point L of the curve A we can produce an infinite number of lines that will touch the curve B. These lines will all be the generators of a cone that has the point L as vertex and the curve B as its base, but beyond that their position is not defined. Two curves are, therefore, not sufficient to direct the motion of a generating straight line; but if a third condition, which the line shall be bound to fulfil, is given, the three conditions can be only satisfied by a limited number of lines, and this defines the position of each generator that passes through the points L, L^1, L^{11} of curve A.

In fig. 211 a straight line is made to slide along three curves, A, B, C, and we shall see that this obligation is sufficient to determine completely the motion of the straight line which thereby generates a skew surface. For, if we imagine two cones with both their apexes in the point L, and, the one having the curve B for base, the other the curve C for base, these two cones will cut one another along a limited number of straight lines, which, like the line G L M N, will, of course, touch the three curves, A, B, C. These lines are, therefore, the positions which the generator will take when, in sliding along the curve A, it reaches the point L. The same operation could be done for other points L^1, L^{11}, . . ., and we should get thereby a series of generators of a surface.

A surface engendered as above will nearly always be skew; for when the generator passes from its position, G L M N, to the neighbouring position, G^1 L^1 M^1 N^1, it may be considered as sliding along the tangents, L T, M U, N V, which are the prolongations of elementary portions of the curves. Now, if these three tangents are not in one plane, neither can the two generators G and G^1 be in one plane. We see, therefore, that in general *the surface described by a straight line sliding on three curves is skew.* It may happen that in a certain position of the generator the tangents M U and N V be in one plane; in that case, there will be a plane element to the surface all along that generator, and the tangent plane will be tangent all along that line, but this will be an exceptional case. In fact, the skew surface will not be a skew surface along that one generator.

Cylindroïds (fig. 212) are surfaces engendered by *a straight line which slides along two given curves* A *and* B, *and which remains always parallel to a given plane* P, called the *Directing Plane.* To produce a series of generators of the cylindroïd we have only to cut the two

first floor communicating with the chapel by means of an open corridor. The dormitories are arranged with dwarf divisions down the centre, the beds being placed head to head, as well as along the walls. The aged wards have the bath-rooms on the same level, the able-bodied baths being on the ground-floor. The dormitories are so arranged that each ward is supervised by an officer's bed-room with a fixed light.

The latrines are placed in towers connected with passages, with cross ventilation, the horizontal soil-pipes being of lead inside the building, the down-pipes being of iron, trapped at the connexion with the drain, and carried up to the top of the tower, and finish with a ventilator, which acts as an exhaust and inlet; the other ends of the soil-pipes are also carried up to the top of the tower, and have exhaust cowls, the bottom of the pipes being left open: by this means it is impossible to syphon out the water in the traps of the closets. The ventilation of the drain-pipes is arranged in the manholes the drains all being laid in straight lines.

The principle adopted for the ventilation of the wards consists of tube-inlets fixed about 7 ft. from the floor, the outlets being arranged in four brick flues to each ward, which are finished at the top with Boyle's ventilators, the current being assisted by means of a conical gas-burner fixed in the flues.

The gas-pendants are also provided with ventilating-tubes carried into the flues, the tubes being laid with a slight incline towards the flue, to assist the current as the fumes cool.

The heating is done by hot-water pipes, the water being heated by steam from the boilers; there are in addition open fireplaces for the sake of cheerfulness.

The buildings are designed for 1,200 paupers, and the administrative block has been carried out completely; the wards at present built are intended for 620 only, the additional accommodation being left to be provided, if required, by extending the pavilions northwards.

The children are provided for in buildings which are kept quite apart from the adult inmates, and, as they are sent away to Anerley to school, no provision for school-rooms has been made.

The casual wards are not yet built, but they will be placed away from the workhouse.

Mr. Aldwinckle kindly met the members of the Association and conducted them over the buildings, giving a very full and interesting description of the various arrangements; and great interest was exhibited in the various fittings, which have all been specially designed for the building, and which appear to be admirably suited for their various purposes.

BRITISH ARCHÆOLOGICAL ASSOCIATION.

The second meeting of the new session was held on Wednesday, December 2nd, Mr. Thomas Morgan, F.S.A., in the chair.

Mr. Cecil Brent, F.S.A., exhibited several curious Roman vases of Upchurch ware and Samian ware, found in excavating for a new gasometer near Canterbury Castle.

Sir Henry Dryden reported the discovery of a sepulchral slab in Moulton Church, Northants, with a curious but not unfrequent pattern of Mediæval times, which has not yet been explained.

In the discussion which followed, one of the speakers considered that the pattern was intended for two bows of double curvature, a rectangular bar with barbed heads being intended for an arrow.

Mr. J. T. Irvine exhibited a large number of curious stones and crosses, mostly in Northants, of Saxon date. He described also a portion of a Roman column covered with leaf-pattern, which has been found built up as old material on taking down the central tower of Peterborough Cathedral. A Saxon funeral slab has also been found there in its original position on what was once the cemetery of a small early church, but afterwards enclosed by the larger building.

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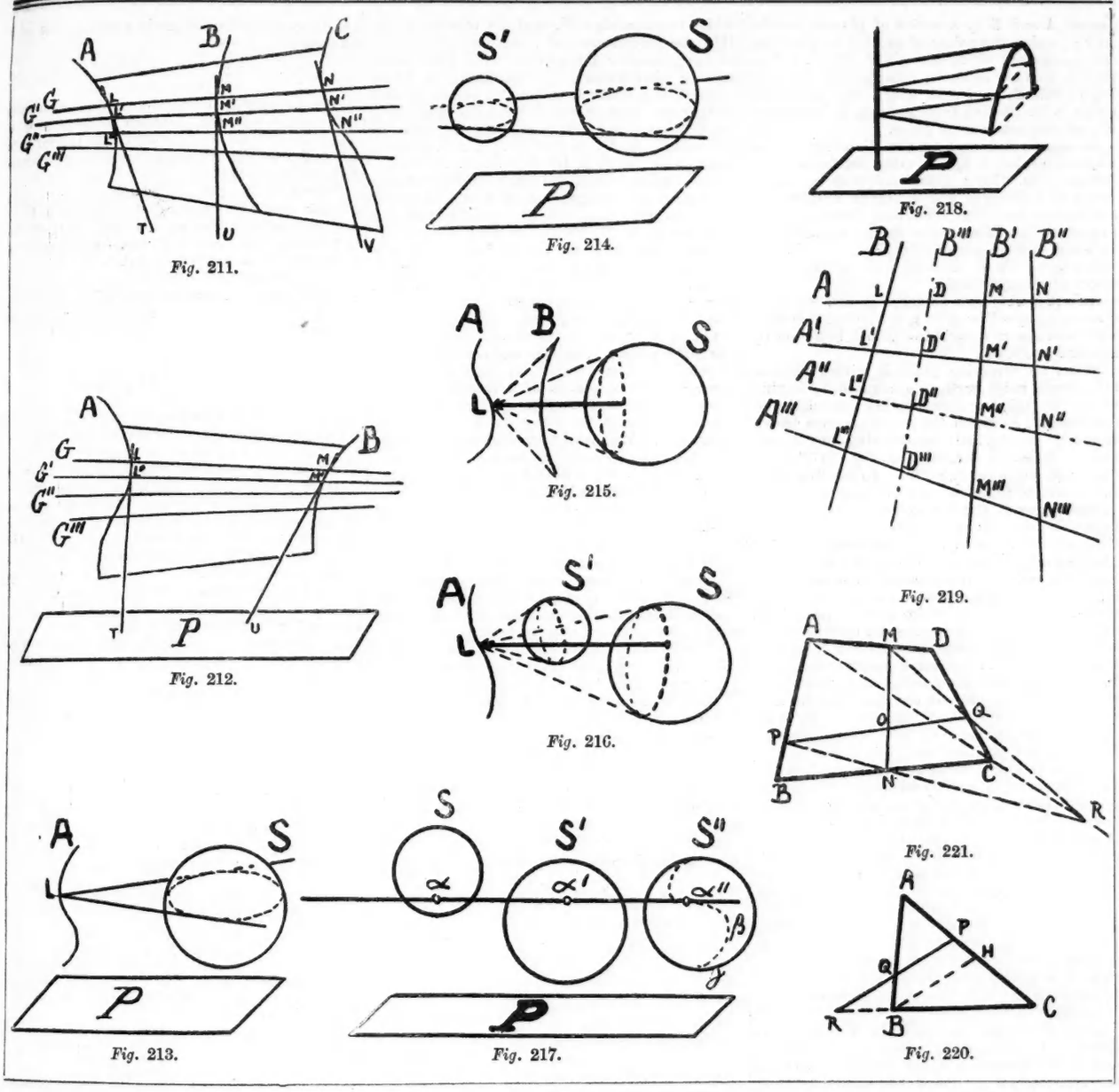

Fig. 211. *Fig.* 214. *Fig.* 218.

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ALL surfaces engendered by the motion of a straight line are *ruled surfaces*. These surfaces are divided into two categories,—the one *developable surfaces*, which we have studied; the other *skew surfaces*, which often occur in masonry, and require our readers' most earnest attention.

Skew surfaces are described by the motion of a straight line, but *two consecutive generators*, however close, *are not contained in the same plane*. This is the essential feature which differentiates skew from developable surfaces.

Before showing how we can produce surfaces the generators of which realise the above condition, we beg to observe that, as a result of that condition, the elementary portion of such a surface comprised between two neighbouring generators *is not a plane*, but *a skew surface*. For (see fig. 211), in all the curves A, B, C . . . . you may delineate on the skew surface, the linear elements L L^1, M M^1, N N^1, which are straight lines, having each one point on G the other on G^1, cannot be in one plane if the generators G and G^1 are not themselves in one plane. Besides this, as the tangents L L^1 T, M M^1 U, N N^1 V . . . . prolongations of the linear elements of the curves are not in one plane, it is evident that the tangent planes G L T, G M U, G N V . . . . *which are tangent to the skew surface in the points* L M N . . . . *of the same generator*, are distinct different planes, although they all contain the generator G.

From the above we conclude also that with skew surfaces every plane, such as G L T, although really tangent to the surface in the point L (this means, containing the tangents to all the curves drawn on the surface through this point), yet cuts the surface in every other point which the plane and the skew surface may have in common. It cuts the surface first along the generator G itself, and secondly along another line which passes through the point L, a line which may be straight or curved according to the shape of the skew surface given.

We shall now show how Skew Surfaces can be produced.

The motion of a straight line is not determined by the line being bound to touch one or even two directing curves; for (see fig. 211) from any point L of the curve A we can produce an infinite number of lines that will touch the curve B. These lines will all be the generators of a cone that has the point L as vertex and the curve B as its base, but beyond that their position is not defined. Two curves are, therefore, not sufficient to direct the motion of a generating straight line; but if a third condition, which the line shall be bound to fulfil, is given, the three conditions can be only satisfied by a limited number of lines, and this defines the position of each generator that passes through the points L, L^1, L^{11} of curve A.

In fig. 211 a straight line is made to slide along three curves, A, B, C, and we shall see that this obligation is sufficient to determine completely the motion of the straight line which thereby generates a skew surface. For, if we imagine two cones with both their apexes in the point L, and, the one having the curve B for base, the other the curve C for base, these two cones will cut one another along a limited number of straight lines, which, like the line G L M N, will, of course, touch the three curves, A, B, C. These lines are, therefore, the positions which the generator will take when, in sliding along the curve A, it reaches the point L. The same operation could be done for other points L^1, L^{11}, . . ., and we should get thereby a series of generators of a surface.

A surface engendered as above will nearly always be skew; for when the generator passes from its position, G L M N, to the neighbouring position, G^1 L^1 M^1 N^1, it may be considered as sliding along the tangents, L T, M U, N V, which are the prolongations of elementary portions of the curves. Now, if these three tangents are not in one plane, neither can the two generators G and G^1 be in one plane. We see, therefore, that in general *the surface described by a straight line sliding on three curves is skew.* It may happen that in a certain position of the generator the tangents M U and N V be in one plane; in that case, there will be a plane element to the surface all along that generator, and the tangent plane will be tangent all along that line, but this will be an exceptional case. In fact, the skew surface will not be a skew surface along that one generator.

Cylindroïds (fig. 212) are surfaces engendered by *a straight line which slides along two given curves* A *and* B, *and which remains always parallel to a given plane* P, called the *Directing Plane.* To produce a series of generators of the cylindroïd we have only to cut the two

curves A and B by a series of planes parallel to P; joining the points of section we shall get the generators G L M, G^1 L^1 M^1, ... &c. Such a surface is skew, because the tangents LL^1T, MM^1U, ... on which the generator slides, when passing from position G to position G^1, are not in the same plane.

In every ruled surface, the directing curves may be replaced by directing surfaces. For instance (fig. 213) a cylindroïd may be engendered by a straight line sliding on a surface S and on a curve A, but remaining always parallel to a plane P. If we make in the surface S a series of sections parallel to the plane P, the tangents to those sections will be the generators of the cylindroïd.

Also (fig. 214) two surfaces S and S^1 and a directing plane P may be given; the generators will form again a cylindroïd, and be found by sections as above.

When no directing plane is given, we can still obtain ruled surfaces generated by having either (fig. 215) two directing lines, A and B, and one surface, S, which the generators are bound to touch; or (fig. 216) one directing line, A, and two surfaces, S and S^1; or (fig. 217) three directing surfaces, S, S^1, S^{11}. In fig. 215 generators will be found at the intersection of two cones of apex L, the one having the curve B for base, the other being the cone circumscribed to the surface S. In fig. 216 the generators are also the intersections of two cones of apex L, and both circumscribed to the surfaces S and S^1. In fig. 217 we suppose that we have found a line, G, which touches the three surfaces in a, a^1, and a^{11}; and have produced a cylindroïd by sliding that line G over the surfaces S and S^1, the line G remaining always parallel to a plane, P, selected *ad libitum* parallel to its first position; this cylindroïd will cut the third surface S^{11} along a line a^{11} β^{11} γ^{11}, but in the point a^{11} the generator of the cylindroïd will be, according to the supposition we started from, contained in a plane tangent to the surface S^{11}. This generator is also according to the law of ruled surfaces contained in the plain tangent to the cylindroïd; it is therefore the intersection of these two tangent planes, in other words, it is tangent in a^{11} to the curve of intersection a^{11} β^{11} γ^{11}. Hence the following method of producing the generators of the surface: select any plane P, produce a cylindroïd circumscribing the two surfaces S and S^1, find the intersection of the cylindroïd with the third surface S^{11}. A tangent to the intersection parallel to to the plane P will be a generator of the skew surface which circumscribes the three surfaces, S, S^1, S^{11} given.

Other skew surfaces can be produced on two curves only with some additional condition, such as the generator being bound to make a constant angle with one of the directing lines, or that the length of the generator between the directing curves be made to remain always the same.

A skew surface may be formed by a line sliding on one directing curve only delineated on a surface, S, with the proviso that the generator be bound to remain always normal to that surface. All these modes of generation can be brought back to the general case of a skew surface with three directing curves, and need not be specially studied.

As a subdivision of *cylindroïds* the name of *conoïds* is given to skew surfaces which have a directing plane and two directors, of which one is a straight line, whereas the other may be either a curve or a surface. A *right conoïd* (fig. 218) is one in which the directing straight line is perpendicular to the directing plane P.

When *both directing lines are straight* the conoïd formed is called a *hyperbolic paraboloïd*.

When the surface has *no directing plane*, but *three straight directing lines*, it is called a *hyperboloïd of one sheet*. Both these last surfaces are called skew surfaces of the second degree, because they are the only skew surfaces which can be represented by algebraïcal equations of the second degree. As they possess remarkable properties which serve to solve the problems on all other skew surfaces, we shall study these two surfaces first.

THE HYPERBOLOID OF ONE SHEET.

In fig. 219 a hyperboloïd of one sheet is engendered by a *straight line*, A, *which slides on three given lines*, B, B^1, B^{11}, *which are not all three parallel to any one plane*, and *any two of which are not contained in one plane*. We find the generator A as follows:—Through a point L of a director, B, we produce two planes, of which one contains B^1, and the other contains B^{11}; the intersection of these two planes will be the generator A required. (The same result can be also obtained by producing a plane through the point L and the director B^1, and finding its intersection N with the line B^{11}.) In this way we could produce a series of generators A, A^1, A^{11}, A^{111} . . . . . passing through points L^1, L, L^{11}, L^{111} . . . . . .

The surface described above is necessarily *Skew*; for any two generators, A and A^1, could belong to one plane, only on condition that the directors B, B^1, B^{11} be also in one plane, which, as said before, they are not. This argument is not limited only to the two neighbouring generators, but applies to any two generators; and, therefore, in the hyperboloïd *no two generators whatever belong to one plane.*

The hyperboloïd of one sheet has a very remarkable property, of the highest importance for finding planes tangent to skew surfaces in general, viz., it admits of a second mode of generation in which the generators A become the directors, and the directors B become the generators. We mean that, if a line B is made to slide on any three of the lines A, A^1, A^{11}, A^{111} . . . . the line B will describe the same hyperboloïd as the former line A.

We cannot show this important property without demonstrating a few previous propositions of elementary geometry, and without using some very simple algebraical calculations. The readers who cannot follow these calculations need only accept as proved the results which they will find further on, and then they can pass to the practical applications thereof.

First Proposition (fig. 220).—When across a triangle, A B C, you carry any straight line, P Q R, which cuts the three sides of the triangle, or the prolongations thereof, you form thereby six segments, and *the product of the non-contiguous segments is equal to the product of the three others* as in the formula (x) below:—

(x) $\quad AP.CR.BQ = AQ.BR.CP$

For, if we produce a line B H parallel to P Q R we shall have the following proportions:—

$$AQ : QB :: AP : PH$$
$$CR : BR :: CP : PH$$

By the first proportion we have—

$$PH = \frac{AP.QB}{AQ}$$

By the second—

$$PH = \frac{CP.BR}{CR}$$

Therefore we get the equation—

$$\frac{AP.QB}{AQ} = \frac{CP.BR}{CR}$$

and multiplying each side by divisors we get the formula (x) as above.

Second Proposition (fig. 221).—A *skew* quadrilateral is one the sides of which, like the edges of a warped drawing-board, are not contained in a plane. It may be considered as delineated on two planes which meet one another along a diagonal of the quadrilateral. Now, if in a skew quadrilateral A B C D we produce two straight lines, M N and P Q, which touch the opposite sides of the quadrilateral, and cut one another in the point O, *the product of the four non-contiguous segments is equal to the product of the four other segments*, as in the formula (y) below:—

(y) $\quad AP.BN.CQ.DM = AM.DQ.CN.BP.$

If the two cross-lines M N and P Q cut one another, they are in the same plane, a plane which will also contain the lines P N and M Q. The lines P N and M Q will therefore cut one another in a point, R, on the diagonal, A C, intersection of the two planes A B C and A D C, on which the skew quadrilateral is delineated. From this observation we get that, to obtain in a skew quadrilateral two cross-lines, which cut one another, we can draw one line *ad libitum*, and also select a point, P, of the other; then draw P N R and the line R M, which will intersect the quadrilateral in the point Q. The point Q is the other end of the cross-line P Q.

From the first proposition we know that the triangles A B C and A D C crossed by the lines P N R and M Q R give the following equations:—

$$AP.BN.CR = AR.CN.BP$$
$$CQ.DM.AR = CR.DQ.AM$$

Multiply both equations and strike out the factors common to both sides and you get the formula (y),—

$$AP.BN.CQ.DM = AM.DQ.CN.BP$$

which can be written,—

$$\frac{AP}{BP} \cdot \frac{CQ}{DQ} = \frac{AM}{DM} \cdot \frac{CN}{BN}$$

or in arranging the letters in a consecutive order as formula (z):—

(z) $\quad \frac{AP}{PB} \cdot \frac{CQ}{QD} = \frac{AM}{MD} \cdot \frac{CN}{NB}$

Third Proposition.—Reciprocally, if two cross lines, which cut the opposite sides of a skew quadrilateral, A B C D, satisfy either the formula (y) or (z) we can conclude that these two cross-lines are in a plane.

Fourth Proposition.—Through any two lines you can produce two parallel planes; for, from any point of each line we can produce a parallel to the other line, and the planes which contain each pair of lines will be parallel.

Fifth Proposition.—Parallel planes cut all straight lines in proportional parts (fig. 222). Let the distances between the planes be x and y; by considering the triangles formed on the left-hand line we have:—

$$AB : BC = x : y,$$

and for the same reasons the second line gives the proportion:—

$$DE : EF = x : y,$$

which gives, therefore, the proportion:—

$$AB : BC = DE : EF.$$

The same proportion would apply to any number of lines cut by the horizontal planes.

Now (fig. 219) we can show the double system of generation of the hyperboloïd by proving that *any line* B^{111} *which meets any three of the generators*, A, A^1, A^{111}, *will meet also all the generators of the system* A. As a consequence thereof it will follow that the line B^{111} will belong to the surface of the hyperboloïd constructed on the three directors, B, B^1, B^{11}, and that, therefore, the lines B can describe the hyperboloïd by sliding on any three lines of system A.

As in the first system of generation, the lines A, A^1, A^{111}, meet the lines B, B^1, B^{11}, the quadrilateral L N, N^{111}, L^{111} will give according to formula (z):—

(1) $\quad \frac{L\,L^1}{L^1\,L^{111}} \cdot \frac{N^{111}\,N^1}{N^1\,N} = \frac{L\,M}{M\,N} \cdot \frac{N^{111}\,M^{111}}{M^{111}\,L^{111}}$

As the line A^{11} meets the directors B, B^1, B^{11}, the quadrilateral gives again:—

(2) $\quad \frac{L\,L^{11}}{L^{11}\,L^{111}} \cdot \frac{N^{111}\,N^{11}}{N^{11}\,N} = \frac{L\,M}{M\,N} \cdot \frac{N^{111}\,M^{111}}{M^{111}\,L^{111}}$

As the line B^{111} cuts also the lines A, A^1, A^{111}, the quadrilateral gives again:—

(3) $\quad \frac{L\,D}{D\,N} \cdot \frac{N^{111}\,D^{111}}{D^{111}\,L^{111}} = \frac{L\,L^1}{L^1\,L^{111}} \cdot \frac{N^{111}\,N^{11}}{N^{11}\,N}$

According to equation (1), the second members of equations (2) and (3) are equal, and therefore we have:—

(4) $\quad \frac{L\,D}{D\,N} \cdot \frac{N^{111}\,D^{111}}{D^{111}\,L^{111}} = \frac{L\,L^{11}}{L^{11}\,L^{111}} \cdot \frac{N^{111}\,N^{11}}{N^{11}\,N}$

which is, according to our third proposition, a proof that *the lines* A^{11} *and* B^{111} *meet one another in the point* D^{11}.

Observe that the second members of the equations (1) and (2) are equal to a fixed quantity k, which does not vary when the five lines, B, B^1, B^{11}, A, A^{111}, are fixed. It follows therefore that for any new line, A^1, which meets the three lines B, B^1, B^{11}, we shall have,—

$$\frac{L\,L^1}{L^1\,L^{111}} \cdot \frac{N^{111}\,N^1}{N^1\,N} = k$$

or the equation (5):—

$$\frac{L\,L^1}{L^1\,L^{111}} = k\frac{N\,N^1}{N^1\,N^{111}}$$

Now, if the three lines, B, B^1, B^{11}, were parallel to the same plane, they would, according to our propositions four and five, divide the lines A^1 and A^{111} in proportional parts, so that we should have,—

$$\frac{L\,M}{M\,N} = \frac{M^{111}\,L^{111}}{N^{111}\,M^{111}}$$

The second member of equations (1) and (2) is equal to the fixed quantity k; substitute therein the value of $\frac{L\,M}{M\,N}$, and you have:—

$$k = \frac{L\,M}{M\,N} \cdot \frac{N^{111}\,M^{111}}{M^{111}\,L^{111}} = \frac{M^{111}\,L^{111}}{N^{111}\,M^{111}} \cdot \frac{N^{111}\,M^{111}}{M^{111}\,L^{111}} = 1$$

and, therefore, when the directors B, B^1, B^{11} are parallel, the equation (5) becomes:—

(6) $\quad \frac{L\,L^1}{L^1\,L^{111}} = \frac{N\,N^1}{N^1\,N^{111}}$

a proportion which would prove, according to the fifth proposition, that the lines B and B^{111} were cut by parallel planes, which contain the lines A, A^1, A^{111}. In short, *if the directors* B, B^1, B^{11} *are parallel to a plane, then the generators,*

A, A^1, A^{11} . . . . *are also parallel to a plane*, but a plane different from that to which the directors are parallel. This law applies to the hyperbolic paraboloïd.

Find a tangent plane to the hyperboloïd (fig. 219).

As through every point of the hyperboloïd there passes two generators, one of system A, and the other of system B, and, as these straight lines are their own tangents, it follows that *the tangent plane to the surface in any point contains both the generators of the surface which pass through that point.* Being given three directors, B, B^1, B^{11}, of a hyperboloïd and a point D on a generator, A, we find the tangent plane in that point as follows: Produce two other generators A^1 and A^{11}, then adopting the lines A, A^1, A^{11} as directors, find the generator, B^{111} of the B system; the tangent plane is that which contains the lines A and B^{111}.

If only the plan of the point D of the hyperboloïd be given, the elevation is found by getting the section of the hyperboloïd by a vertical plane, and carrying thereon the elevation of D.

The centre of the hyperboloïd.

The surface of the hyperboloïd has a centre, that is, *there is a point in space which cuts in two equal parts all the straight lines which pass through it and end on the surface of the hyperboloïd*, as will be seen by the following demonstration (fig. 223).

B, B^1, B^{11} are three directors of the hyperboloïd. Through B^1 and B^{11} we take the two planes B^1DC and $B^{11}CD$, both planes being parallel to the third director, B. The line ACD intersection of these planes will be, of course, parallel to B; or, what is the same thing, the line A can be considered as meeting B at an infinite distance. We can, therefore, say that A meets B, B^1, B^{11}, and is a generator of the hyperboloïd. In the same way, we shall find that A^1 parallel to B^1, and A^{11} parallel to B^{11}, are generators of the hyperboloïd; by which we see that *every generator of the system* B *has a parallel generator of the system* A. The six planes which contain the parallel generators named above form a parallelopiped, the six arrises of which are the lines B, B^1, B^{11}, and A, A^1, A^{11}. The centre O of this parallelopiped is evidently the centre of the hyperboloïd; it will be found at the intersection of three planes taken through B and its parallel A, B^1, and its parallel A^1, B^{11} and its parallel A^{11}; for these planes are diagonal planes of the parallelopiped.

For the readers who cannot follow our calculations we sum up the results we have obtained, a summary sufficient for their practical purposes.

Firstly. *There are two systems of generators* A A^1 A^{11} . . . . . *and* B B^1 B^{11} . . . . . *and each generator of one system meets all the generators of the other system* (parallels are supposed to meet at an infinite distance).

Secondly. *Two generators belonging to the same system never meet, and are never parallel.*

Thirdly. *Three generators belonging to the same system are never parallel to one plane.*

Fourthly. *The hyperboloïd has a centre.*

Fifthly. *A straight line can pierce the hyperboloïd in not more than two points.*

We give in fig. 224 a plan and elevation of the hyperboloïd of one sheet, and it will be found to coincide exactly with the hyperboloïd of one sheet we described before (fig. 96, June 6, 1885). The mathematical proof of this we do not give, because it is based on the algebraical representation of this surface. It will suffice to say that any vertical plane tangent to the elliptical throat will cut the hyperboloïd along two straight lines, and that the surface may be considered as generated also by *a straight line sliding on three ellipses, the base, the upper ellipse, and the throat.*

The limiting (prop. asymptotic) cone of the hyperboloïd.

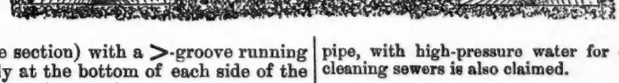
The cone with its apex in the centre, O, and its generators parallel to those of the hyperboloïd, is the *limiting* cone of the hyperboloïd, with properties similar to those we have already seen in hyperboloïds of revolution (fig. 187, Oct. 17, 1885), by which we can know beforehand what kind of section any plane will make in the surface of the hyperboloïd. The section of the hyperboloïd will be an ellipsis, a parabola, or a hyperbola according as the plane of the section is parallel to a plane which forms similar sections in the cone.

As there are always in the hyperboloïd two parallel generators of opposite systems, a plane tangent to the limiting cone will cut the hyperboloïd along two parallel generators. To find a generator of a hyperboloïd parallel to a given plane, cut the limiting cone by a plane passing through its apex and parallel to the one given. The two generators of the cone found in that way are parallel to the plane given, tangent planes to the cone along these generators will intersect the hyperboloïd along generators parallel to the plane given. By this we see that there are four generators of the hyperboloïd parallel to any given plane.

To get a neat drawing where the generators of both systems have the same starting-points, as in fig. 224, draw a circle of centre O with its diameter equal to the major axis of the elliptical base, divide that circle in equal parts, and project them on the elliptical outline of the base; this gives us the starting-points of the generators required.

AN IMPROVEMENT IN WOOD-BLOCK FLOORING.

MESSRS. M. C. DUFFY & SON, of Stork's-road, Bermondsey, have brought to our notice their patented improvements in wood-block flooring, which are worth the attention of architects and building owners, inasmuch as they are well calculated to ensure immovability, and therefore evenness and economy of wear. The salient feature of this method of flooring consists in the use of dowel-pins connecting the blocks together, the dowel-pins being differently disposed to suit different methods of laying,—for the blocks can be laid in a variety of herring-bone and interlacing patterns. The blocks are formed (as shown by the section) with a >-groove running longitudinally at the bottom of each side of the block. Before the blocks are laid they are dipped into a preservative adhesive compound, with which not only the under surface of each block becomes coated so as to form a hard-and-fast joint with the floated concrete and cement substructure, but the adhesive composition takes up and enters into the longitudinal >-grooves before referred to, and thus an additional "keying" or "bonding" together of the whole system ensues.



This method of flooring, which is, we are informed, about to be adopted in the new additions at Harrow School (Mr. Champneys, architect), and at the new post-office at St. Alban's, is called the "Acme" system of solid wood-block flooring.

WHAT IS A "QUARRY"?

SIR,—May I beg a small space in the *Builder* to ask the following question,—What is a quarry? I mean a quarry as known among lead glaziers for, say, the last fifty years. What I wish to arrive at is simply the shape; I have always understood "a quarry" to mean a pane of glass having a point at top and bottom and on either side. I am told, however, that a small square (true square) when glazed in lead, with two of its sides glazed horizontally and the two others, of a necessity, perpendicularly, becomes a quarry, and may be so termed correctly. This I dispute *in toto*. Am I right or wrong? I should add that I call a "square" a "quarry" if glazed standing on one of its points, or, to be more correct, corners.

TEN TO THE FOOT.

P.S.—Laxton and all other builders' Guides say "leaded lights in squares *or* quarries." Are *they* also all wrong?

Lambeth, Dec. 8th, 1885.

*** In the literal meaning of the word, our correspondent is, of course, wrong. "Quarrel" or "quarry" is probably a corruption of the French *carré*, "a square," though Richardson's Dictionary gives it as from "*quarreau*," "a little square." In either case it is more properly applicable to a square than to a lozenge pane. But custom seems rather the other way. Nicholson's "Dictionary of Architecture" gives "*Quarrel*: a lozenge-shaped pane of glass; same as *quarry*." Gwilt says, "*Quarrel*, vulgarly *quarry* (French, *carré*): a square *or* lozenge-shaped pane of glass used in lead casements." The "Glossary of Architecture" says "*Quarrel*: a diamond-shaped pane of glass, or a square one placed diagonally." Johnson says,—"*Quarrel*: square of glass." "Worcester's Dictionary gives,—"*Quarry*: a diamond-shaped piece of glass." It thus appears that recent custom takes it to mean a diamond shape; but it is quite certain the word itself implies no such thing, and has only come to mean that, because, when it came into use, it was the habit to put the panes lozenge-wise. If anything turned upon it in law, it would be a rather nice point to decide.

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

11,517, Raising and Lowering Windows. J. Eaton.

The sash is provided with rollers at the top, which slide in grooves in the framing, and it is attached at its lower end to a string, which, passing over a roller, is fastened at its free end to a weight slightly heavier than the sash. The roller is acted upon by any suitable brake, which can be released from the inside; when this is done the weight falls and raises the sash.

12,689, Flush Handles, Rings, &c. J. Walker.

A broad flat blank, similar to a bow in shape, is stamped from sheet metal. The ends of the blank are pressed into a trough-like form, but the centre is of a circular shape. The pins or pivots on which the handle hangs pass through the sides of the trough.

14,324, Kiln for Cement. C. Dietzsch.

The kiln is divided into a cooling space, a burning space, and fire-heating chamber, a passage connecting the first two spaces. The chambers are oblong in shape, and the kiln is lined with basic material.

14,492. Scouring Sandbanks and Flushing Sewers. B. H. Thwaites and B. D. Healey.

Powerful jets of water are caused to impinge against the sand, by the means of a distributing conduit provided with nozzles. For shallow water this conduit is arranged along the keel of a caisson, which is water ballasted to the right depth. A hose-pipe, with high-pressure water for divers and for cleaning sewers is also claimed.

14,800, Furnace Roof. J. E. Bott.

The roof is constructed in removable arched sections, each consisting of suitable bricks clamped together, and lying loosely on the walls, by which means free expansion is allowed for, and the skew-backs for taking the thrust dispensed with. Leakage at the ends is prevented by loose sand placed on the walls of the furnace.

NEW APPLICATIONS FOR PATENTS.

Nov. 27.—14,553, W. Brierley, Manufacture of Bricks and Tiles.—14,559, R. Lee and J. Hodgson, Construction of Fireproof Pillars and Columns.—14,584, E. Wright, Improvements in Saws.

Nov. 28.—14,619, T. & J. Fawcett, Machinery for Pressing Bricks, Brickettes, Tiles, &c.—14,625, W. Smith, Surfacing Asphalte Roadway or Pavement to abate its Slipperiness.

Nov. 30.—14,674, W. Kimber, Prevention of Noise in Syphon-action Flushing Cisterns for Water-closets, &c.—14,695, C. Carson, Electrical Apparatus for Releasing Door and similar Fastenings.—14,707, M. Chuboche, Improved Stove or Fireplace.

Dec. 1.—14,718, G. Thomas, Apparatus for Automatically Removing Water from Gas-pipes, &c.—14,725, R. Lee and J. Hodgson, Manufacture of Concrete Slabs, Blocks, Pipes, &c.—14,726, R. Lee and J. Hodgson, Manufacture of Concrete Fireproof Building Materials, &c.—14,730, J. Denny, Double Lock-and-Key Blocks for Fireproof, Ventilating Ceilings, and Floors (combined).—14,731, S. Pickering, W. Pickering, and J. Norton, Improved Door Check and Spring.—14,760, G. Haydon, Escutcheons for the Keyholes of Street Door and other Locks.—14,772, W. Lake, Manufacture of Nails.—14,775, R. Legg, Stall Boards for Shop Windows.

Dec. 2.—14,794, R. Anderson, Apparatus for Ascending Chimneys, &c.—14,812, F. Trier, Machines for Cutting, Dressing, Turning, Planing, and Shaping Stone.—14,815, L. White, Manufacture of Portland Cement.—14,816, C. Gumpel, Friction Clutch for Holding Window Sashes and Sliding Frames in any desired Position.—14,825, E. Brennan, Window-sash Fastenings.

Dec. 3.—14,866, R. Somers, Improvements in Fireplaces.—14,870, W. Hitchin, Holdfasts for Windows, Ventilator-Shutters, Window-blinds, &c.

PROVISIONAL SPECIFICATIONS ACCEPTED.

8,772, E. Webb, Attaching and Adjusting Door Knobs and Handles to Spindles.—12,706, J. W. and R. Green, Improvement in Kitchen or Room Fire-

grates.—12,908, S. Pitt, Manufacture of Lime-Cement, Applicable to the Production of Cements, Mortars, Hydraulic Concretes, and Artificial Stone, replacing Natural Stone.—12,991, W. Kinsman, Sanitary Joint for Pipes.—13,194, J. Lockwood, Improvements in Cooking Ranges.—13,221, J. Boam, Improved Method of treating Iron Ores, Oxides of Iron, &c., to be used in the Manufacture of Paints, Colours, &c.—13,591, J. Sutherland, Apparatus for Preventing the Entrance of Wind, Dust, or Rain under Doors, &c.—13,722, F. Fidler, Improvements in Locks and Latches.—13,891, J. Freeman, Improved White Pigment.—14,060, W. Cliff, Manufacture of Water-closets.—14,065, E. Robbins, Improved Tesseræ or Mosaic for Building Purposes, &c.—14,116, W. Rowe, Improvements in Water-closets.—10,087, J. Johnson, Fastenings for Window Sashes.—12,620, F. Morris and J. Fox, Apparatus for Securing Sliding Sashes.—13,173, W. Brewer, Devices for Fastening Windows, &c.—13,357, W. Aish, Improvements in Bradawls, Chisels, &c.—13,622, F. French, Fasteners for Window Sashes, &c.—13,675, F. Smith, Appliances for Ventilating Rooms and other Enclosed Spaces.—14,127, M. Opperman, Improved Mode of Producing Window Glass.—14,128, J. B. Spence, Preparation of Materials to be used in Making Paint.

COMPLETE SPECIFICATIONS ACCEPTED.

Open to opposition for two months.

202, A. Boult, Improvements in Stoves.—264, J. Walker, Cupboard and Other Door Fastenings.—609, E. Tomlinson, Ventilation and Treatment of Smoke, &c.—950, H. Walker and G. Clark, Improvements in Fire Grates.—1,148, A. Mackie, Door Check.—1,166, H. Walker and G. Clark, Improvements in Kitchen Ranges.—1,596, R. Wilson and Others, Improvements in Chimney Tops.—2,095, J. Doulton, Fireproof Floors.—2,160, E. Colton, Improved Wall or like Decorations, and Method of Manufacturing same.—5,097, S. Jackson, Concealed Outlet and Deep Flooding Closet.—8,182, A. Boult, Safety Device for Screw Fastenings.—12,177, W. Benson, Improvements in Hinges.—15,857, H. Gardner, Surfacing Compound for Coating Buildings, &c.—16,821, J. Herbert and T. Colley, Sash Bar Cramp for Carpenters and Joiners.—12,605, G. Thornton, Preventing the Violent Closing or Slamming of Doors.—13,161, W. Doehring, Watchman Detector and Alarm Apparatus.—13,294, H. Lake, Preservation of Wood.—13,321, J. Simmons, Window Fastenings.

RECENT SALES OF PROPERTY.

ESTATE EXCHANGE REPORT.

Nov. 26.

By Thurgood & Martin.

Lingfield, Surrey—Freehold cottage and 6¼ acres...	£410
"Linkins" Meadow, 3¼ acres	335
Three freehold cottages	395
"Pollard's" Farm, and 21a. 1r. 30p., freehold ...	655
"Jack's Bridge" Farm, and 46a. 3r. 10p., freehold	1,500
"Rowland's" Farm, 80a. 0r. 39p., freehold	2,500

Nov. 27.

By Walford & Wilshin.

Upper Norwood—45 and 47, Anerley-road, freehold	280

By Baker & Sons.

South Africa—Forty-nine Claims, and 49 Acres of Depositing Ground, with Plant, &c.	3,300

By Jones, Lang, & Co.

Milton-street, E.C.—Freehold Ground-rent of 78*l.* 15s., reversion in 35 years	2,420
Peckham—121 and 123, Kimberley-road, 88 years, ground-rent 10*l.*	335

Nov. 30.

By L. Farmer.

Maida Vale—1 to 4, Elgin-terrace, 76 years, ground-rent 24*l.*	1,455

By G. Pratt.

East Dulwich—2 and 3, Saratoga Villas, 93 years, ground-rent 10*l.*	440
3, Elizabeth-terrace, 96 years, ground-rent 5*l.*	180

Dec. 1.

By C. & H. White.

Plaistow, Kent—19, Crescent-road, freehold	400

By Thurgood & Martin.

Godstone—An enclosure of land, 11a. 0r. 10p., freehold	453
"Brooklands" Farm, 34a. 2r. 37p., freehold	1,750
Enclosures of land, adjoining, 29a. 0r. 1p.	1,300

By Henderson & Pewtress.

Homerton—53, High-street, 74 years, ground-rent 10*l.*	250

By B. Brown.

Poplar—5, 6, and 7, Lodore-street, freehold	515
8, Perry's Close, 71 years, ground-rent 3*l.* 8s.	360
Bromley—29 and 31, Willis-street, 89 years, ground-rent 6*l.*	315
7, Gray-street, freehold	165

By Debenham, Tewson, & Co.

City—29, Plough-court; and 1 to 7, Plough-place, freehold	1,820
Belgravia—184, Buckingham Palace-road, 16 years, no ground-rent	480

Dec. 2.

By Briant & Son.

Kennington—5, Farmer's-road, 40 years, ground-rent 4*l.*	185
Chelsea—12, 13, and 14, Bury-street, freehold	1,020
Battersea—111 and 113, High-street, freehold	530
Clapham—83 to 97 odd, Meyrick-road, 64 years, ground-rent 37*l.* 10s.	1,440
Wandsworth—The lease of 80, Northcote-road, term 14 years	760

By R. J. Collier.

Stoke Newington—83, Fairholt-road, 94 years, ground-rent 12*l.*	530
79 and 81, Fairholt-road, in carcass	660
60, 62, and 67 to 77 odd, Fairholt-road, in carcass	1,250

By Mr. Robertson.

Camberwell—40, Brunswick-terrace, 37 years, ground-rent 3*l.* 3s.	£405

Dec. 3.

By Hards & Jenkinson.

Richmond—"The Princess of Wales" Beer House, freehold	480

MEETINGS.

SATURDAY, DECEMBER 12.

Association of Municipal and Sanitary Engineers and Surveyors.—Northern District Meeting, Town-hall, Gateshead).—Visits to Works, and the following papers:—(1) "On Iron Cylinder Foundations," by Mr. James Bower; (2) "On Disconnected Slopstone Pipes, with Suggestions of an Improved Method," by Mr. Cosmo C. Hooley. 10·30 a.m.

MONDAY, DECEMBER 14.

Royal Institute of British Architects.—Paper by Mr. William White, F.S.A., enttiled "A Week at Wisby in Gothland." 8 p.m.

Royal Academy.—Professor A. H. Church on "Colour and Colours."—IV. 8 p.m.

Architectural Section of the Philosophical Society of Glasgow.—Mr. A. Lindsay Miller on "Fireplaces and Chimneys."

TUESDAY, DECEMBER 15.

Institution of Civil Engineers.—Further discussion on Mr. John Imray's paper on "High-Speed Motors" and on Mr. Gisbert Kapp's paper on "Continuous Current Dynamo-Electric Machines and their Engines." 8 p.m.

Statistical Society.—Mr. Thomas Scrutton on "The Preventible Loss of Life at Sea." 7·45 p.m.

WEDNESDAY, DECEMBER 16.

Royal Academy.—Professor A. H. Church on "Colour and Colours."—V. 8 p.m.

Society of Engineers.—Annual Dinner, Guildhall Tavern. 6 p.m.

Civil and Mechanical Engineers' Society.—Mr. G. Eedes Eachus on "The Ventilation of Sewers." 7 p.m.

West London School of Art.—Sir P. Cunliffe Owen will distribute the Medals and Prizes gained by the Students. 8 p.m.

Parkes Museum.—Ordinary General Meeting of Members to receive Report from Council, &c. 5·30 p.m.

Builders' Foremen and Clerks of Works' Institution.—Ordinary Meeting. 8·30 p.m.

Society of Arts.—Mr. Holt S. Hallett on "Burmah, Present and Future." 8 p.m.

THURSDAY, DECEMBER 17.

Society of Antiquaries.—Professor Boyd Dawkins on "A Bronze Hoard from Eaton, near Norwich." 8·30 p.m.

London Institution.—Captain Abney, F.R.S., on "Light and the Atmosphere." 7 p.m.

York Architectural Association.—Mr. S. W. North on "The Sites of Houses as affecting Health." 7·30 p.m.

Edinburgh Architectural Association.—Mr. David M. Westland, C.E., on "Foundations." 8·30 p.m.

Dundee Institute of Architecture.—Mr. George Macdougald on "Smoke Consumption." 7 p.m.

FRIDAY, DECEMBER 18.

Architectural Association.—Mr. J. A. Gotch on "English Houses of the Seventeenth Century." 7·30 p.m.

University College.—Professor C. T. Newton, C.B., on "Greek Myths illustrated by Fictile Vases and other Monuments."—III. 4 p.m.

Royal Academy.—Professor A. H. Church on "Colour and Colours."—VI. 8 p.m.

Society of Medical Officers of Health.—Dr. E. C. Seaton on "The Recommendations of the Royal Commission on the Housing of the Working Classes as they affect the Status of the Medical Officer of Health." 7·30 p.m.

Institution of Civil Engineers (Students' Meeting).—Mr. F. Geere Howard on "The Propulsion of Tram-cars and Launches by Secondary Batteries." 7·30 p.m.

Miscellanea.

Awards for Architecture at the Royal Academy.—The following awards were made on Thursday evening last:—Gold Medal and Travelling Studentship in Architecture, subject "A Town House," Thomas MacLaren; architectural drawing, subject "The North Porch of St. Paul's Cathedral," 1st, Silver Medal, F. W. Troup; 2nd, Silver Medal, Lionel Littlewood; set of architectural designs, Upper School, E. Guy Dawber; set of drawings of an architectural design, Lower School, W. Leck; Silver Medal for perspective drawing, not awarded. We will give the awards for Painting and Sculpture next week.

A Non-freezing Solution for Heating Apparatus.—In the *Builder* of October 3 we printed part of a paper read at the Leicester Sanitary Congress by Mr. E. C. Robins on "The Ventilation and Warming of Chemical Laboratories," in the course of which Mr. Robins said of the Bristol school heating apparatus, that "to prevent accidents by frost, the pipes were filled with a non-freezing solution of chloride of calcium." We are asked to state that the application of the solution in question is a patent of Mr. William Stainton, of King's-cross-road.

The London Pavilion Music Hall.—We are asked to state that the sliding roof at this music-hall was supplied and fixed by Messrs. Rownson, Drew, & Co., who also furnished the structural ironwork for the building.

Another Architect Elected M.P.—Mr. Banister Fletcher, F.R.I.B.A., has been elected M.P. for the Chippenham Division of Wiltshire.

The Plumbers' Company.—On the 4th inst., under the presidency of the Master (Mr. G. Shaw), a Livery dinner of the Plumbers' Company was held at the Albion, Aldersgate-street, and the attendance was one of the largest and most representative that has ever assembled under the banner of this ancient Company. "Sanitary Science and its Institutions throughout Great Britain" was proposed from the Chair, the Master referring with evident satisfaction to the conference which had been held under the auspices of the Company, and at which a system of registering master plumbers and journeymen as a means of benefiting the craft was determined upon. He said it was an undoubted fact that a bad workman was an evil not only to the craft, but to himself, his neighbours, and the public at large. After much discussion, the scheme was now almost completed, and a second meeting would shortly be called to consider it. Assistance and co-operation had been promised by Lord Fortescue and other members of the two Houses of Parliament in any step that the Company might take. It was his hope that the day might come when the Plumbers' Company would be recognised as one of the chief sanitary institutions of Great Britain. Professor de Chaumont and Dr. Ernest Hart, who responded, devoted their remarks to reviewing the progress which had been made of late years in sanitary science, the latter remarking that for the past twenty years 8,000 lives a year had been saved. Dr. Vacher, who also replied, urged how important it was to the public to secure the execution of plumbing work by competent craftsmen. With the toast of "Architecture and the Building Trades," the names of Mr. Ewan Christian, P.R.I.B.A., Mr. George Godwin, F.R.S., and Mr. E. C. Robins, F.S.A., were coupled. The toast of the Company itself was received with enthusiasm, it being mentioned by the Lord Mayor that Mr. G. Shaw had been Master of the Company for three years in succession, and that the scheme of regeneration in the work of plumbing had been nearly if not wholly brought about by him.

Trade Inquiry Agencies.—The case of Part *v.* Wilson was an action heard in the Derby County Court on Monday last, before Judge Woodforde. Mr. Oswald E. Part, cement manufacturer, Derby, sued E. P. Wilson & Co., of London, to recover the sum of 3*l.* 3s. for a subscription paid to the defendants on their representation that they could make inquiries as to the solvency of proposed customers. The plaintiff called upon them to make such inquiries and they declined to do so. After hearing the evidence, his Honour said he regretted that he was compelled to give the verdict he was about to do, because the country was inundated with people who were forcing themselves upon the attention of the public, and getting up all kinds of plans for every sort of purpose. The defendants induced the plaintiff to enter into this so-called association, because it was a similar firm to Messrs. Stubbs's, a well-known firm. It was a stupid thing on the part of the plaintiff to employ a man on his mere statement that the business was the same as Messrs. Stubbs's, but he did employ him without taking the trouble to make inquiry. The plaintiff allowed himself to be decoyed into the payment of the subscription, but what he did he did with his eyes open. He was sorry he could not help him, and he was equally sorry to assist such an association. There would be a verdict for the defendant without costs.

Extensive New Sewerage Works.—We are informed that the tender of Messrs. B. Cooke & Co., of Battersea, has been accepted for the construction of the whole of the sewers in the Friern Barnet Sewerage Works, the amount of the contract being 22,820*l.* The same firm are constructing the outfall works at Silvertown for the West Ham Local Board, the contract amount being 10,464*l.*

The Late General Earle.—Messrs. Jones & Willis, of Birmingham, have been entrusted with the execution of a memorial brass, which is to be erected in memory of the late Major-General Earle, who was killed in the recent Soudan campaign. The brass is to be fixed in the English church at Alexandria.

The Parkes Museum.—The ordinary general meeting of the members of the Parkes Museum will be held in the Museum Library, No. 74A, Margaret-street, Cavendish-square, London, W., on Wednesday next, December 16, at 5·30 o'clock p.m., to receive the report of the Council, and to transact other business.

Association of Municipal and Sanitary Engineers and Surveyors.—A Northern District meeting will be held at Gateshead this Saturday, the 12th inst. Members will assemble at half-past ten a.m. in the Town-hall (kindly granted for the occasion by the Mayor, Alderman McDermott). The members will, after the transaction of the usual routine business and election of a district secretary, proceed to visit (under the guidance of Mr. Bower, the Borough Surveyor) :—1. The North-Eastern Company's Railway Erecting Shops. 2. Messrs. Hawks, Crawshay, & Co.'s Works. 3. The Saltwell Park. 4. The Gateshead Quay and Swing Bridge over the river Tyne. On returning to the Town-hall the following papers will be read and discussed :—"Iron Cylinder Foundations," by Jas. Bower, C.E., Borough Surveyor, Gateshead; "Disconnected Slop Stone Pipes, with Suggestions of Improved Method," by Cosmo C. Hooley, A.M.I.C.E., Surveyor to the Barton-upon-Irwell Union.

Royal School of Mines.—Prof. Warington Smyth, F.R.S., in resuming his lectures on mining, in the Theatre of the Geological Museum, Jermyn-street, referred to the various objects to be served in boring operations, remarking that they were not confined to the discovery of mineral and ore, but extended over a large field, prominent among others being the necessary investigations entered into by responsible parties as to the nature of the ground proposed as a site for a large and important building, as well as the prospects which might be held in regard to its water-yielding properties. In regard to the former, he wished particularly to call attention to the careful examination which the nature of the ground upon which so immense a structure as St. Paul's Cathedral was to be built, obtained at the hands of its architect. Sir Christopher Wren sank bore-holes in a number of places, and the statement of the conclusions he arrived at has been confirmed by posterity; but his geology was slightly at fault in so far as he mistook fresh water for marine formations. Old St. Paul's stood upon the loam or brick-earth, which often forms the upper layer of the great bed of gravel covering the London clay. Sir Christopher concluded that this very close and hard loam, or, as he termed it, "pot-earth," which had carried so massive a building in the past, might reasonably be expected to carry *his* building; but he would trust nothing to calculations founded upon assumptions. He found the loam to be about 6 ft. thick, below this a bed of dry sand was met with, afterwards sand and water containing shells, below this hard beach, and then came the London clay. He supposed the beach and shells to be of marine origin, while, in reality, they were fresh-water formations. The London clay is a good and solid foundation, but, lying some 40 ft. below the surface, it was considered by Wren too deep, and he therefore decided to build upon the loam, when, on proceeding from west to east, he discovered, in the north-east corner, a pit where all the loam seemed to have been extracted, as if for some commercial purpose, probably by the potters. Seven additional feet would have enabled him to complete the design. He knew perfectly well that neither the dry sand nor the other beds, till he came to the solid clay, could be depended upon. He refused to entertain the idea of piling, arguing, with much reason, that the inconstant nature of the water-presence in the sand and other beds would render that unsuitable. His only resort, in these circumstances, was to build upon the clay, and he therefore ran up a solid pier of good masonry, 10 ft. square, till he came within 15 ft. of the surface, when he turned a substantial arch across to the other foundation, upon which arch the remaining portion of the building was then erected. There is one remaining danger, however, an eventuality which the late Mr. C. R. Cockerell did much to render conspicuous by the public prominence which he gave to it. The bed of sand carrying the loam upon which the other portions of the building rest, if pierced by a drain, might be run off, so to speak, leaving the loam above unsupported. Mr. Cockerell was the means of preventing the carrying out of a deep sewer on the south side of the Cathedral which had been actually commenced, by calling attention to the danger which then existed. In regard to the water-yielding property of certain formations, Prof. Smyth dwelt at length upon the manner of sinking artesian wells.

PRICES CURRENT OF MATERIALS.

TIMBER.	£.	s.	d.	£.	s.	d.
Greenheart, B.G. ....ton	6	10	0	7	10	0
Teak, E.I. ....load	12	10	0	15	10	0
Sequoia, U.S. ....ft. cube	0	2	6	0	2	9
Ash, Canada ....load	3	0	0	5	0	0
Birch ,, ...load	3	0	0	4	10	0
Elm ,, ...load	3	10	0	5	0	0
Fir, Dantsic, &c.	1	10	0	4	10	0
Oak ,, ...	3	0	0	5	0	0
Canada ,, ...	6	0	0	7	0	0
Pine, Canada red	3	0	0	4	0	0
,, yellow	3	15	0	5	5	0
Lath, Dantsic ....fathom	4	10	0	6	0	0
St. Petersburg	5	0	0	7	0	0
Wainscot, Riga....log	2	15	0	4	10	0
,, Odessa	3	12	6	3	15	0
Deals, Finland, 2nd and 1st...std. 100	7	10	0	8	10	0
,, 4th and 3rd	6	0	0	7	10	0
Riga	6	0	0	8	0	0
St. Petersburg, 1st yel.	9	0	0	15	0	0
,, 2nd ,, ...	7	0	0	8	15	0
,, white	8	0	0	10	10	0
Swedish....	6	0	0	15	10	0
White Sea	8	0	0	18	0	0
Canada, Pine 1st	17	0	0	31	10	0
,, 2nd	12	0	0	17	10	0
,, 3rd, &c.	7	0	0	10	0	0
,, Spruce 1st	9	0	0	12	0	0
,, 3rd and 2nd	6	0	0	8	0	0
New Brunswick, &c....	5	0	0	7	0	0
Battens, all kinds	4	0	0	12	0	0
Flooring Boards, sq. 1 in.—Prepared, first	0	9	0	0	13	0
Second	0	7	6	0	8	6
Other qualities	0	5	0	0	7	0
Cedar, Cuba....foot	0	0	3½	0	0	4
Honduras, &c.	0	0	3	0	0	4
Australian	0	0	3	0	0	3½
Mahogany, Cuba	0	0	5	0	0	7½
St. Domingo cargo av.	0	0	5½	0	0	7½
Mexican ,, ...	0	0	4	0	0	5
Tobasco cargo av.	0	0	4	0	0	6½
Honduras cargo av.	0	0	4½	0	0	6½
Maple, Bird'seye	0	0	3½	0	0	6
Rose, Rio ....ton	7	0	0	16	0	0
Bahia....	6	0	0	14	0	0
Box, Turkey	5	0	0	18	0	0
Satin, St. Domingo .... ft.	0	0	0	0	0	0
Porto Rico	0	0	0	0	0	0
Walnut, Italian	0	0	4	0	0	5

METALS.	£.	s.	d.	£.	s.	d.
IRON—Pig in Scotland ....ton	2	2	6	0	0	0
Bar, Welsh, in London....	4	15	0	5	0	0
,, ,, in Wales	4	7	6	4	10	0
,, Staffordshire, London	5	15	0	7	0	0
Sheets, single, in London....	7	10	0	9	0	0
Hoops ,, ...	6	5	0	7	10	0
Nail-rods ,, ...	5	15	0	7	0	0
COPPER—						
British, cke. and ingt. ....ton	45	0	0	46	0	0
Best selected	46	0	0	47	0	0
Sheets, strong....	54	0	0	0	0	0
,, India	48	0	0	48	10	0
Australian, fine cash....	0	0	0	0	0	0
Chili, bars ,, ...	41	0	0	41	10	0
YELLOW METAL....lb.	0	0	4½	0	0	4½
LEAD—Pig, Spanish	12	5	0	0	0	0
English, com. brands	12	12	6	0	0	0
SPELTER—						
Silesian, special ....ton	15	2	6	15	5	0
Ordinary brands	14	17	6	14	15	0
TIN—						
Banca	96	0	0	0	0	0
Billiton	94	0	0	0	0	0
Straits	93	17	6	93	7	6
Australian	93	17	6	93	7	6
English ingots....	97	0	0	0	0	0
ZINC—						
English sheet	17	0	0	17	10	0

OILS.	£.	s.	d.	£.	s.	d.
Linseed ....ton	21	0	0	21	7	6
Cocoanut, Cochin	30	0	0	30	10	0
Ceylon	27	0	0	27	5	0
Copra....	0	0	0	0	0	0
Palm, Lagos	29	10	0	0	0	0
Palm-nut Kernel	25	10	0	26	0	0
Rapeseed, English pale....	24	0	0	0	0	0
,, brown	22	0	0	22	2	6
Cottonseed, refined	19	0	0	21	0	0
Tallow and Oleine	25	0	0	40	0	0
Lubricating, U.S.	7	0	0	10	0	0
,, Refined	4	0	0	10	0	0
TURPENTINE—						
American, in cks. ....cwt.	1	6	6	1	6	9
TAR—Stockholm ....brl.	0	18	6	0	19	0
Archangel....	0	11	6	0	12	0

COMPETITIONS AND CONTRACTS.

Epitome of Advertisements in this Number.

COMPETITIONS.

Nature of Work.	By whom required.	Premium.	Designs to be delivered.	Page.
Sewage Scheme	Newhaven Local Board	50*l.*	Jan. 14th	ii.
Detached Hospital	Montrose Royal Lun. As.	Not stated	Not stated	ii.

CONTRACTS.

Nature of Work, or Materials.	By whom required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.	Page.
Kerbing, Tar-paving, &c....	Lewisham Brd. of Wks.	*Official*	Dec. 15th	ii.
Coal Offices, West Kensington....	Midland Railway Co.	A. A. Langley	Dec. 17th	xvi.
Four Cottages, Boat-house, &c.	Admiralty	*Official*	Dec. 18th	ii.
Sewerage Works....	West Ham Local Board	Lewis Angell....	Dec. 22nd	ii.
Storehouse and Offices, &c., &c.	The Corporation of Trinity House	*Official*	Dec. 31st	xvi.
New Post-Office at Wisbech	Com. of H.M. Works ...	do.	Jan. 1st	ii.
Collection, &c., of Dust	Wandsworth Bd. of Wks	do.	Jan. 5th	xvi.

TENDERS.

BRENTWOOD.—For proposed residences on the Brentwood Hill Estate. Messrs. Haltridge & Cubitt, architects :—

	Design A.	Design B.
Sabey & Son....	£2,350	£2,600
Glassock & Son	2,356	2,492
Paine Bros.	2,191	2,285
Leslie & Knight	2,151	2,245
W. Marriage....	2,104	2,240
Staines & Son	2,098	2,198
D. C. Jones	2,044	2,086
Shillitoe & Son....	1,900	2,000
J. Reynolds	1,549	1,886

BRISTOL.—For alteration and extension of No. 14, Mall, Clifton, for Mrs. Griffey. Mr. Herbert J. Jones, architect, Bristol :—

J. Bastow	£525	0	0
W. Church	493	0	0
Eastbrook & Sons	459	0	0
T. R. Lewis	455	0	0
G. Humphreys (accepted)	447	0	0

[All of Bristol.]

CANTERBURY.—For removing existing buildings and erecting in place thereof cellar and fermenting room at the Dane John Brewery, Canterbury, for Messrs. Ash & Co. Messrs. H. Stopes & Co., architects, Southwark-street :—

Wiltshire, Canterbury	£1,867	0	0
Brookes, Folkestone	1,860	0	0
Denne & Son, Deal	1,690	0	0
Austen & Lewes, Dover....	1,559	0	0
Hayward & Paramor, Folkestone ...	1,550	0	0
Willis, Dover....	1,550	0	0
Wise, Deal	1,549	0	0
Shrubsole, Faversham....	1,548	0	0
Grist, Aylesbury	1,518	0	0
Stiff, Dover....	1,498	0	0
Gaskin, Canterbury	1,450	0	0
Adcock, Dover (accepted)....	1,395	0	0

HACKNEY.—For enclosing additional land and building covered playgrounds at Morning Lane Schools, for the School Board for London. Mr. T. J. Bailey, architect :—

C. Cox	£686	0	0
G. S. Pritchard & Son	648	10	0
W. Shurmur....	594	0	0
J. F. Sargeant	542	0	0

HORNSEY.—For making-up of the carriageway of a portion of Ridge-road, for the Hornsey Local Board. Mr. T. de Courcy Meade, engineer and surveyor :—

Wiswell, City	£563	5	6
Heard, Hoxton....	475	0	0
Pizzey, Hornsey	469	12	0
F. A. Jackson & Son, Finsbury Park	438	0	0
J. Jackson, Enfield....	415	7	6
Mowlem & Co., Westminster	411	0	0
Nicholls, Wood Green	407	0	0
A. Walker, Upper Holloway *....	385	0	0

* Accepted.

KILBURN.—For the erection of stabling, &c. at Fernhead-road, West Kilburn, for the London General Omnibus Company, under the superintendence of Mr. G. T. Lanham. Quantities by Mr. Bolton :—

Godson....	£4,540	0	0
Hartley	4,223	0	0
Roberts	3,952	0	0
Dearing & Son	3,908	0	0
Evans	3,889	0	0
Parker....	3,875	0	0
Garrud....	3,737	0	0
Grist....	3,678	0	0
Knight....	3,670	0	0
Richens & Mount	3,659	0	0
North Bros....	3,600	0	0
Hunt	3,513	0	0
Haynes	3,500	0	0
Manley	3,457	0	0

LEICESTER.—For the construction of a main sewer, with bellmouths, side entrances, flushing arrangements, manholes, lampholes, &c., for the New Gas Works and Aylestone-road. Quantities by J. Gordon, C.E., Borough Surveyor:—

Kennington & Garth, Sheffield	£5,894	13	6
Thomas Smart, Nottingham	5,630	10	3
Currall & Lewis, Birmingham	5,588	11	10
Hy. Hughes, Dudley	5,499	11	6
Innes & Wood, Birmingham	5,456	0	6
B. W. Ward, Whetstone	5,419	1	0
E. Tempest, Keighley (accepted)	5,184	19	2
S. W. Filling & Co., Manchester	4,847	16	0

LONDON.—For alterations and additions to No. 55, Foley-street, Oxford-street, for Mr. Brangan. Mr. E. C. Robins, architect, John-street, Adelphi:—

Watson	£785	0	0
Cooper	759	0	0
Searchfield & Son, Clapham	752	13	0

LONDON.—For re-building "The Cock" tavern in the new street leading from Piccadilly to Bloomsbury, for Mr. W. Knight. Messrs. Wylson & Long, architects, King William-street, Strand. Quantities by Mr. Arthur W. Saville, Strand:—

S. R. Lamble	£2,989	0	0
S. Belham & Co.	2,987	0	0
John Anley	2,975	0	0
Ward & Lamble	2,969	0	0
W. Shurmur	2,880	0	0
Spencer & Co.	2,803	0	0
Benjamin Cook	2,761	0	0
John Walker	2,718	0	0
John Beale	2,700	0	0
William Oldrey (accepted)	2,694	0	0

LONDON.—For erection of stables, Union-street, Oxford-street. Mr. H. H. Stoneham, architect:—

Wood Bros.	£573	0	0
Colley	545	0	0
J. Morter	530	0	0
Steel Bros.	497	0	0
Jackson & Todd	489	0	0
W. Shurmur	486	0	0
G. Johnson	485	0	0

LONDON.—For building five houses in Herne-place, Dulwich-road, for Mr. George Monk:—

W. D. Palmer, Dulwich-road *	£1,400	0	0

* Accepted.

LONDON.—For alterations at the "Duke of Wellington," Nile-street, Hoxton. Mr. W. Miles, surveyor:—

E. T. Lynn	£210	0	0
W. Shurmur	180	0	0
Jackson & Todd	163	0	0

SHOREDITCH.—For erection of stables for Messrs. Rotherham & Co., Shoreditch. Messrs. Hovenden, Heath, & Berridge, architects:—

Clarke & Bracey	£5,664	0	0
G. H. & A. Bywaters	5,467	0	0
W. Holland	5,288	0	0
Ashby & Horner	5,170	0	0
E. Conder	4,998	0	0
Scrivener & Co.	4,988	0	0
Prestage	4,980	0	0
Patman & Fotheringham	4,971	0	0
W. Shurmur (accepted)	4,788	0	0

SOUTHWARK.—For new warehouse at rear of No. 213, Blackfriars-road, for Mr. R. Morgan. Mr. E. R. Hewitt, architect:—

H. Baguley	£1,210	0	0
J. Holloway	1,095	0	0
J. H. Mills	1,080	0	0
R. C. Scott	1,075	0	0
Holloway Bros.	1,062	0	0
J. Hoare & Son	998	0	0
W. Downs (accepted)	992	0	0

TORQUAY.—For additions to Broadlands. Mr. John Watson, architect. Quantities by Messrs. J. Mullins & A. Watson:—

Goss	£1,045	0	0
Chubb	1,0 0	0	0
Smerdon	987	17	0
Matthews	933	0	0
Vanston & Mumford	894	10	0
Wyatt	821	0	0
Watson Bros.	907	0	0
Yeo (accepted)	699	18	0

WINCHMORE HILL.—For iron fencing, &c. for Metropolitan Asylums Board, Winchmore Hill. Messrs. Pennington & Bridgen, architects and surveyors:—

George Bell	£621	0	0
Bayliss, Jones, & Bayliss	549	13	3
Wall Bros.	545	0	0
Abbott & Co.	518	0	0
Rowland Bros.	491	0	11
Hill & Smith	486	12	0
Johnson Bros.	468	0	0
Rowell & Co.	466	6	8
E. C. & J. Reay	432	18	0

YARMOUTH.—For sea-water works for the Great Yarmouth Corporation. Mr. J. W. Cockr[illegible], Borough Surveyor. Quantities supplied by Borough Surveyor:—

W. J. Botterill, 110, Cannon-street, London	£4,973	0	0
Charles Lewis Witham, Essex	4,742	2	0
H. J. C. Keymere, Gorleston	4,675	0	10
J. F. W. Bray, Yarmouth	4,612	0	0
G. H. Springall, Yarmouth	4,500	0	0
C. & S. Frere & Co., 8, Suffolk-lane, London (accepted)	3,987	0	0
[Surveyor's estimate	£4,200	0	0]

SPECIAL NOTICE.—Lists of Tenders frequently reach us too late for insertion. They should be delivered at our Office, 46, Catherine-street, W.C., *not later than Four p.m.* on THURSDAYS.

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F. P. (not within our scope).—G. A.—J. T.

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